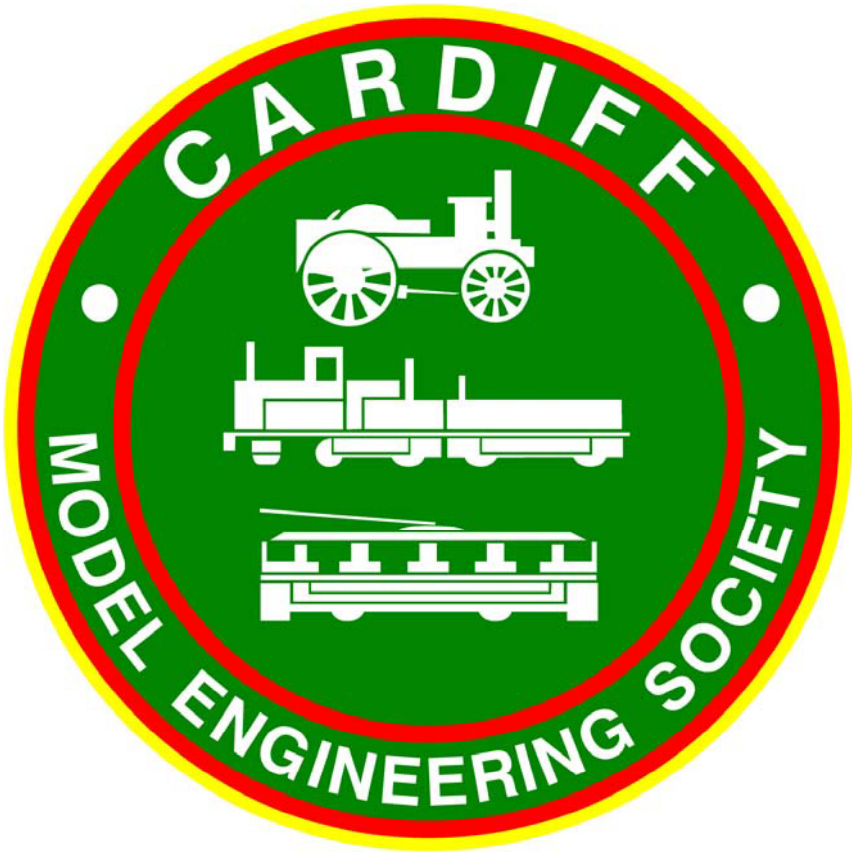


Ground Level Riding Cars.

MANUAL

While we do not require any payment for the use of this manual, we would be grateful for any donation to our new clubhouse building fund.

Please contact the **secretary @ cardiffmes.com**

CARDIFF MODEL ENGINEERING SOCIETY

Ground Level Riding Cars.

Introduction.

The ground level riding cars are designed and constructed as a folded steel main body with wooden end blocks. Two bogies per car are used with full compensation and a rubber based suspension to ensure clean riding without derailment. The leading bogie is braked by an automatic vacuum braking system; this braking system is automatic fail safe.

There are two standards of ground level car; seven built in the 1980's and six built in the late 1990's.

The earlier cars are hand painted in Burgundy and lined and labelled in a different manner, they are numbered 19 to 26, They have green seat squabs, currently the brake cylinders are being altered to the PNP cylinders which have been deemed as the standard for our cars, the bogie wheel base is shorter and therefore the bogies are further apart by a small amount.

The newer cars are finished by a professional car shop, and lined in gold with a printed vinyl badge centred on the sides, they are numbered 30 to 36 they have grey seat squabs, the wheel base of the bogie is extended approx 2" and the bogie centres are shorter by a small amount, the body of the cars is lower by about one inch and so have greater resistance to derailing during passenger loading and unloading.

The running boards are wooden stained mahogany.

A board is fitted at each end with hand holds these boards are again finished mahogany stain. The purpose of these boards is to prevent passengers being able to reach the coupling gear while not forming a hand trap when the train is cornering.

The seats are sponge on ply and covered in grey or green vinyl.

The cars are designed to seat between 5 and 6 passengers depending on their size; the limitation of passenger number is physical space not the weight of passengers.

The braking system is set to stop the train in a distance consistent with not throwing the passengers forward. Every car's brakes are set to a standard that ensures that each car in a train is applying equal braking power. We expect a train of cars to stop within two or three car lengths consistent with the above criteria of not throwing passengers about from 5mph without the motive power pulling.

Coupling of cars within the train is by fixed length draw bars with high tensile steel screws acting as draw pins. Interconnection of the vacuum system through the train is by nylon tube and push in type connectors.

Wherever possible construction is from readily available commercial parts; thus ensuring speedy and effective repairs and maintenance.

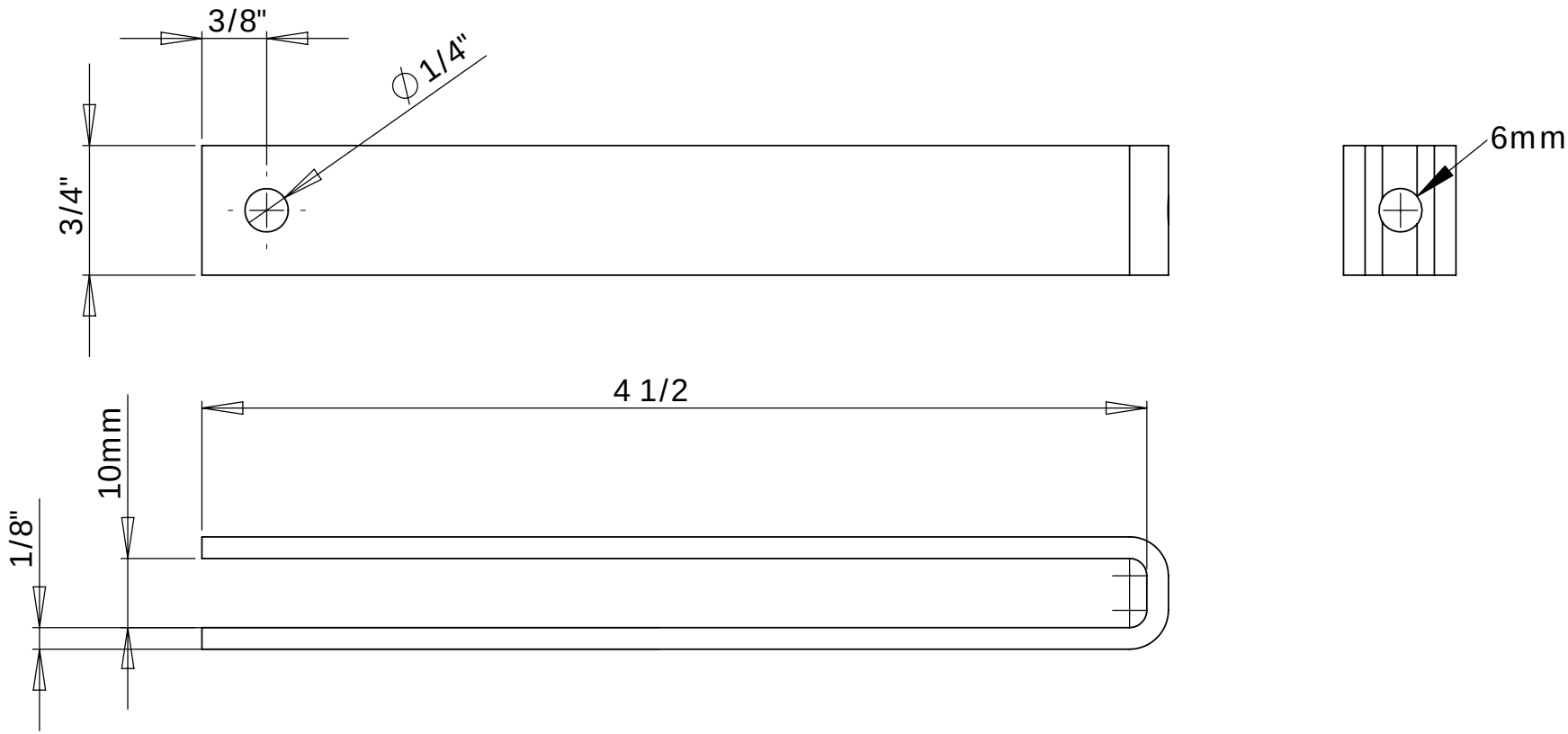
This manual describes the construction, testing and maintenance of the ground level cars.

CARDIFF MODEL ENGINEERING SOCIETY

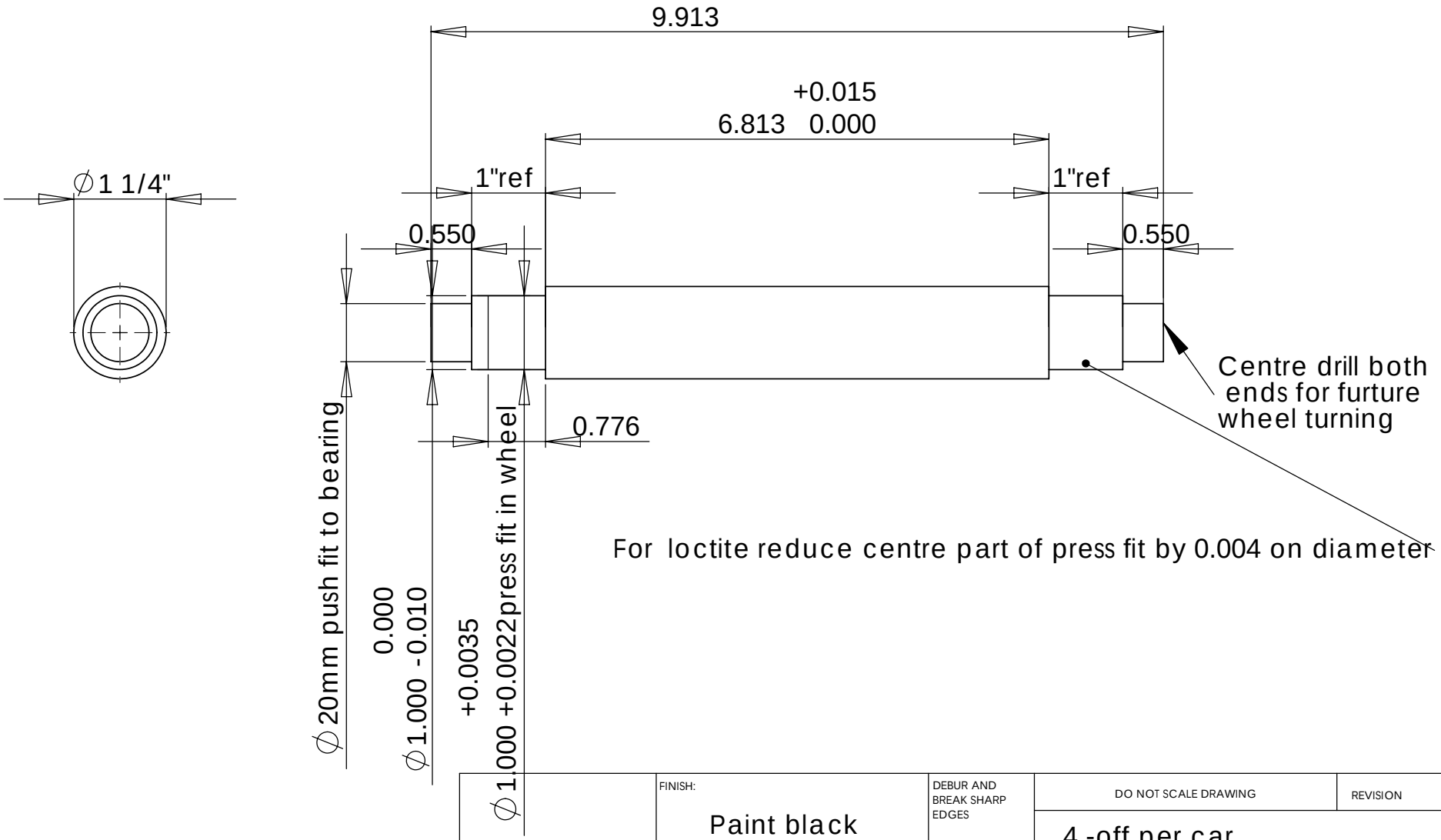
Ground Level Riding Cars.

Index

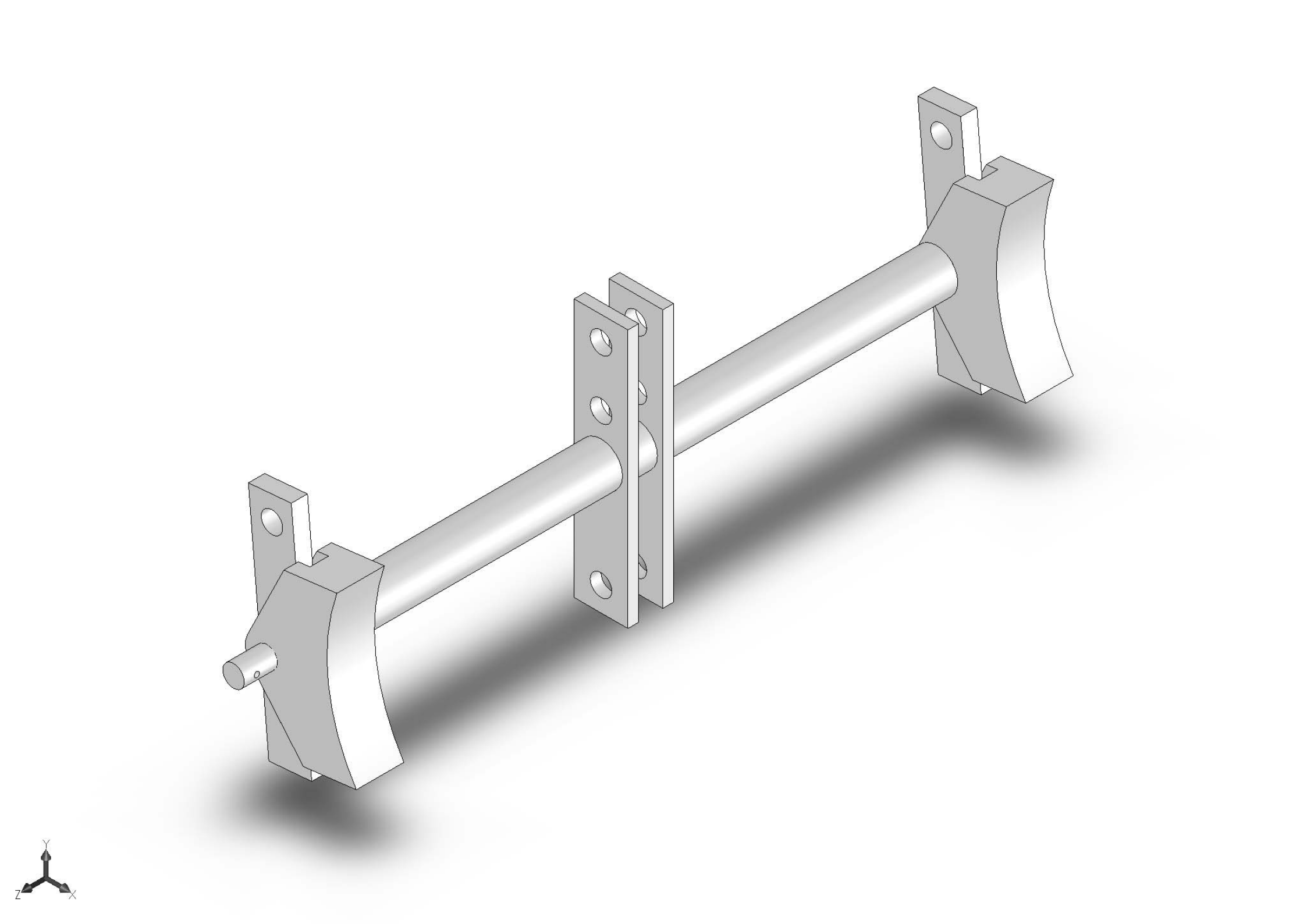
Item	Title	Qty per car	Material	revision no.
1	Adjustment Clevis	1	mild steel	1
2	Axle	4	mild steel	1
3	Axle Assembly	4	2,4,41	1
4	Bearing Housing	8	aluminium	1
5	Body	1	mild steel	1
6	Body End Angle	2	mild steel	1
7	Body Stretcher	2	mild steel	1
8	Body Stretcher Assembly	2	7,9,38	1
9	Body Stretcher End	4	mild steel	1
10	Bogie Braked	1	26,3,15,27,43,29	1
11	Bogie Pivot	2	mild steel	1
12	Bogie Stretcher Drawing	2	mild steel	1
13	Bogie Stretcher Ends	4	mild steel	1
14	Bogie Stretcher 3D	2	12,13	1
15	Brake Pin	4	mild steel	1
16	Brake Shoe	4	plastic	1
17	Brake Lever 1	2	mild steel	1
18	Brake Lever 2	2	mild steel	1
19	Buffer Back	2	wood	1
20	Buffer Front	2	wood	1
21	Car End Wood	2	wood	1
22	Cylinder Bracket	1	mild steel	1
23	Draw Bracket	2	mild steel	1
24	Draw Bar	1	mild steel	1
25	Endboard	2	plywood	1
26	Frame	4	mild steel	1
27	Front Shoe Set	1	17,16,28	1
28	Inner Beam	1	mild steel	1
29	Lever	1	mild steel	1
30	Outer Beam	1	mild steel	1
31	Push Rod	1	mild steel	1
32	Pivot Pin	2	mild steel	1
33	Pull Rod	1	mild steel	1
34	Pull Rod Coupling	1	mild steel	1
35	Rubber Block	8	rubber	1
36	Support Block	4	35,37,42	1
37	Support Block 3D	4	35,37,42	1
38	Support Bracket	4	mild steel	1
39	Vacuum Plate	1	aluminium	1
40	Vacuum Plate Rear	1	aluminium	1
41	Wheel	8	mild steel	1
42	Wood Block	4	wood	1
43	Back Shoe Set	1	16,18,30	1



		FINISH:		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION	
					1 -off per car		
	NAME	SIGNATURE	DATE			TITLE:	
DRAWN	J Styles		12/5/07				
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL: MILD STEEL		DWG NO. adjustment clevis	A4
				WEIGHT:		SCALE:1:2	SHEET 1 OF 1



		FINISH: Paint black		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					4 -off per car	
	NAME	SIGNATURE	DATE		TITLE:	
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: MILD STEEL	DWG NO. axle	A4
				WEIGHT:	SCALE:1:5	SHEET 1 OF 1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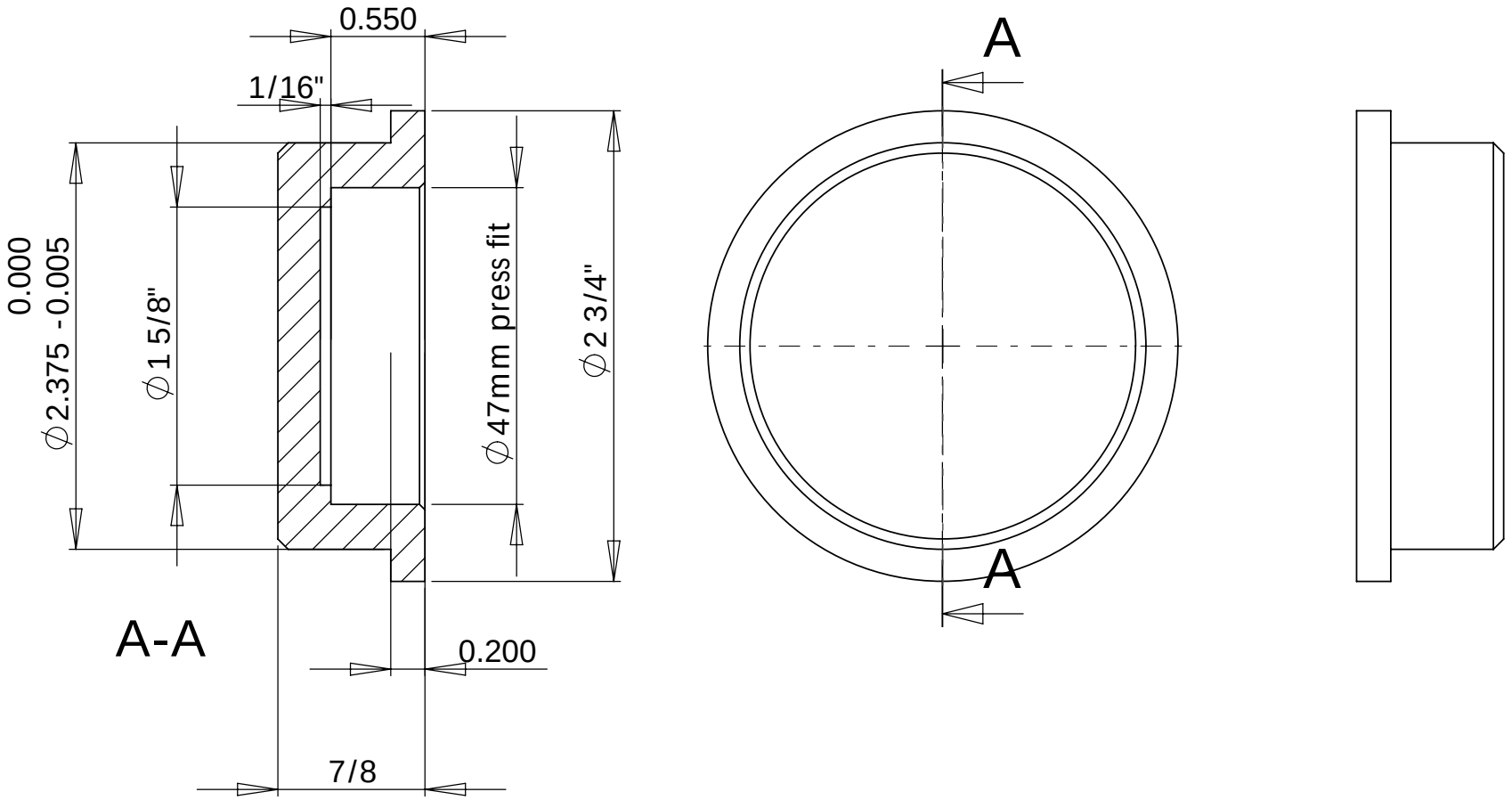
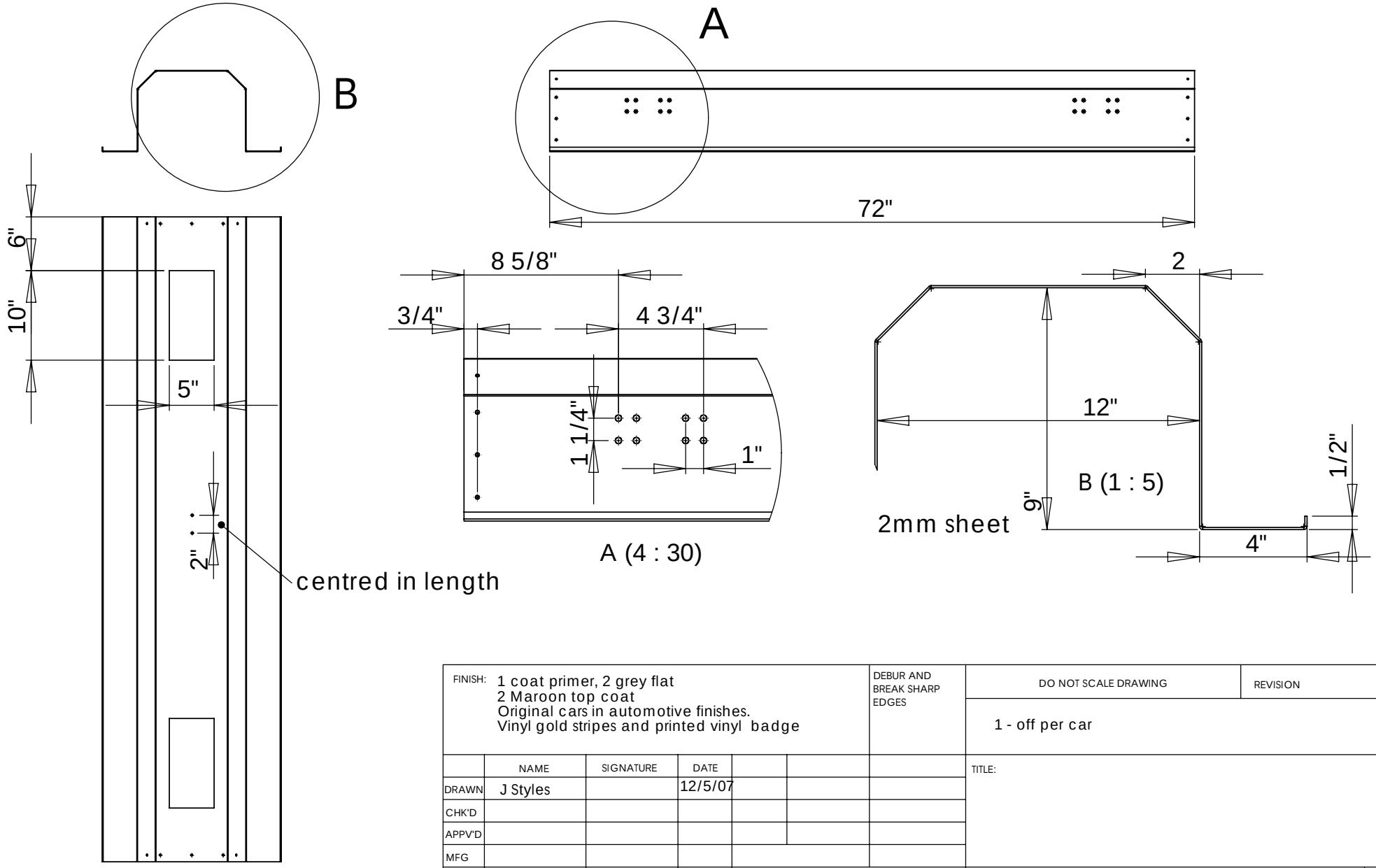
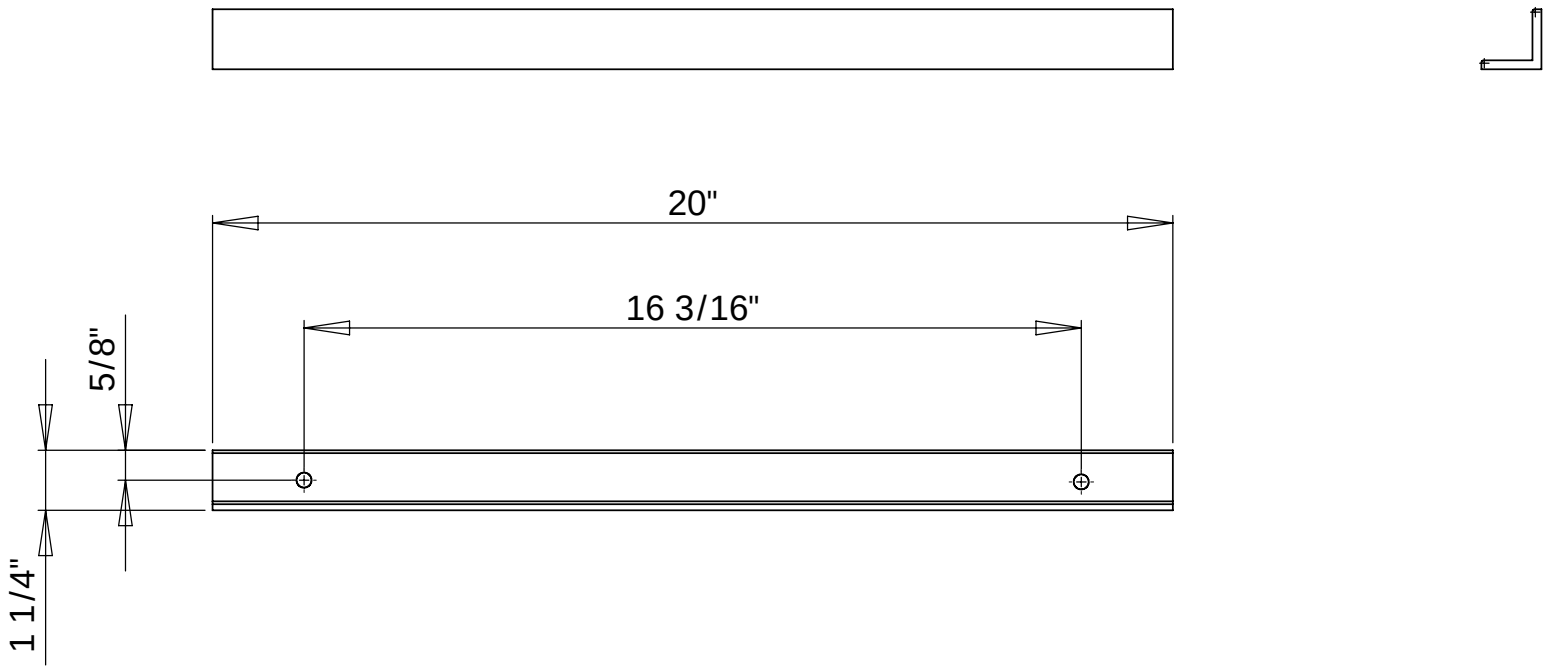


			FINISH: Natural		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
						8 -off per car	
	NAME	SIGNATURE	DATE			TITLE:	
DRAWN	J Styles		12/5/07				
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL: Aluminium		DWG NO. bearing housing	A4
				WEIGHT:		SCALE:1:1	SHEET 1 OF 1

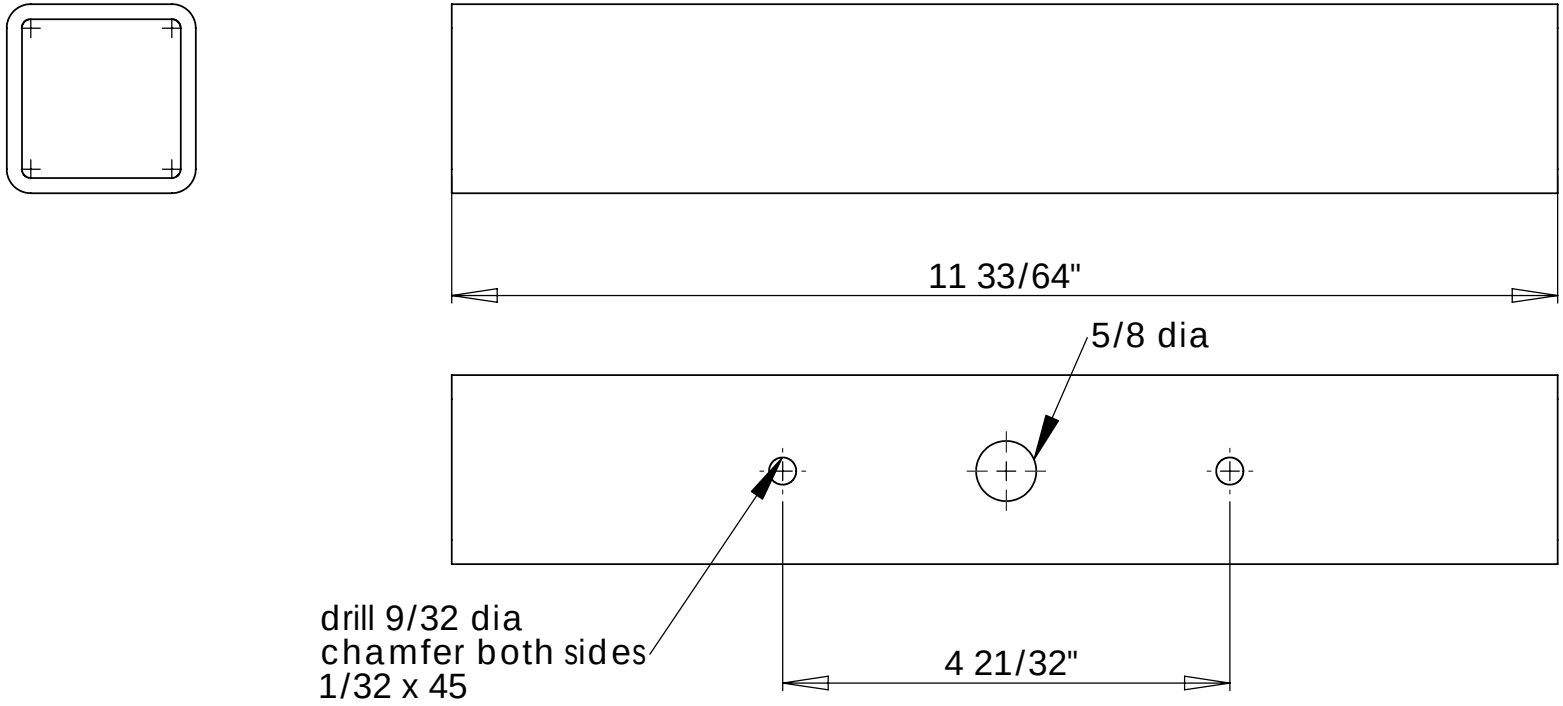


FINISH: 1 coat primer, 2 grey flat 2 Maroon top coat Original cars in automotive finishes. Vinyl gold stripes and printed vinyl badge						DEBUR AND BREAK SHARP EDGES
	NAME	SIGNATURE	DATE			
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: 1.5 mm MS sheet folded		
				WEIGHT:		

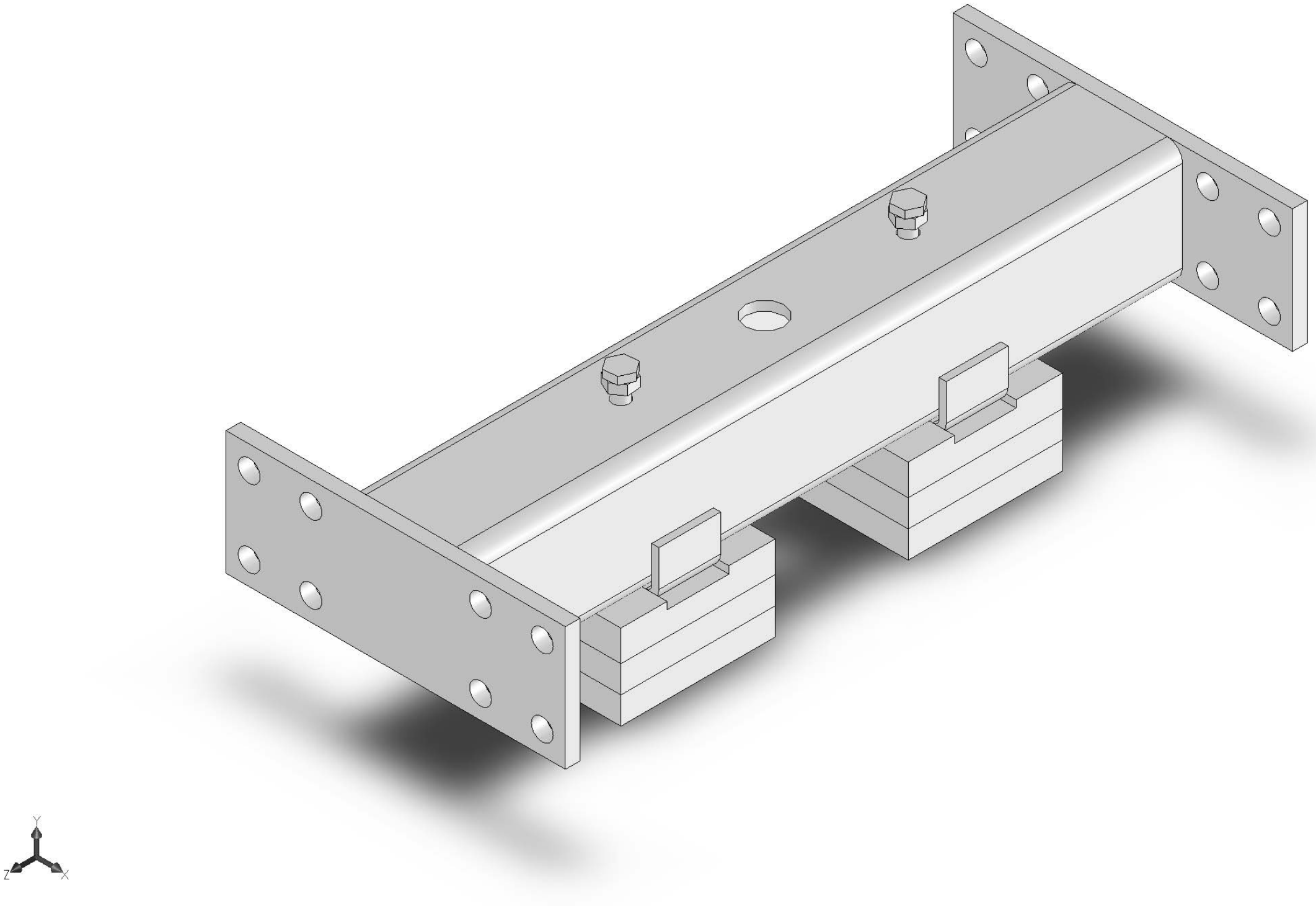
DO NOT SCALE DRAWING	REVISION
1 - off per car	
TITLE:	
DWG NO. body	A4
SCALE:1:50	SHEET 1 OF 1



			FINISH: Black Paint			DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING / REVISION
							2 -off per car
	NAME	SIGNATURE	DATE				TITLE:
DRAWN	J Styles		12/05/07				
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL: Mild Steel			DWG NO. body end angle / A4
				WEIGHT:			SCALE:1:5 / SHEET 1 OF 1



		FINISH:		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					2 -off per car	
	NAME	SIGNATURE	DATE		TITLE:	
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: Square hollow section 50mmx50mmx4mm wall	DWG NO. body stretcher	A4
				WEIGHT:	SCALE:1:5	SHEET 1 OF 1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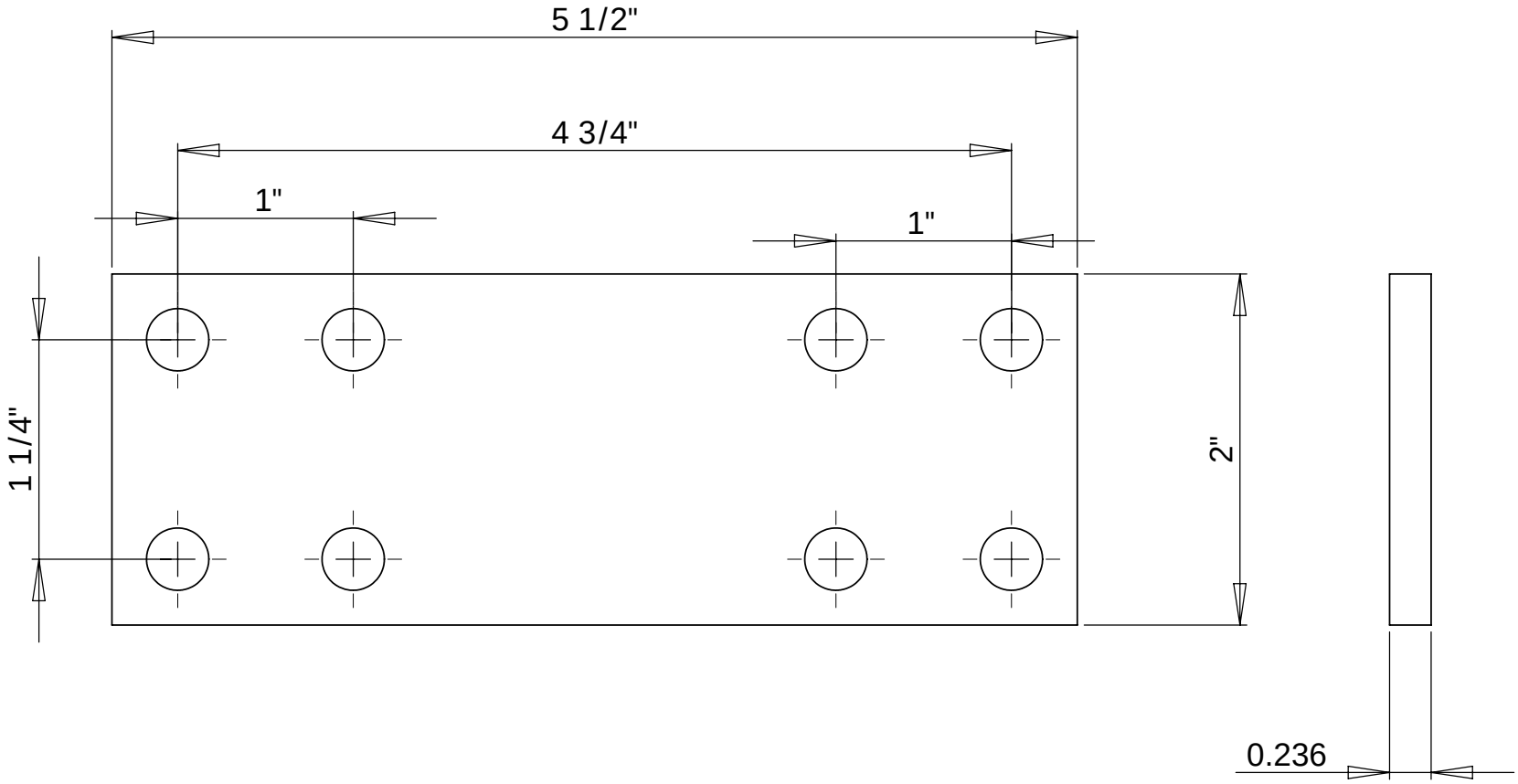
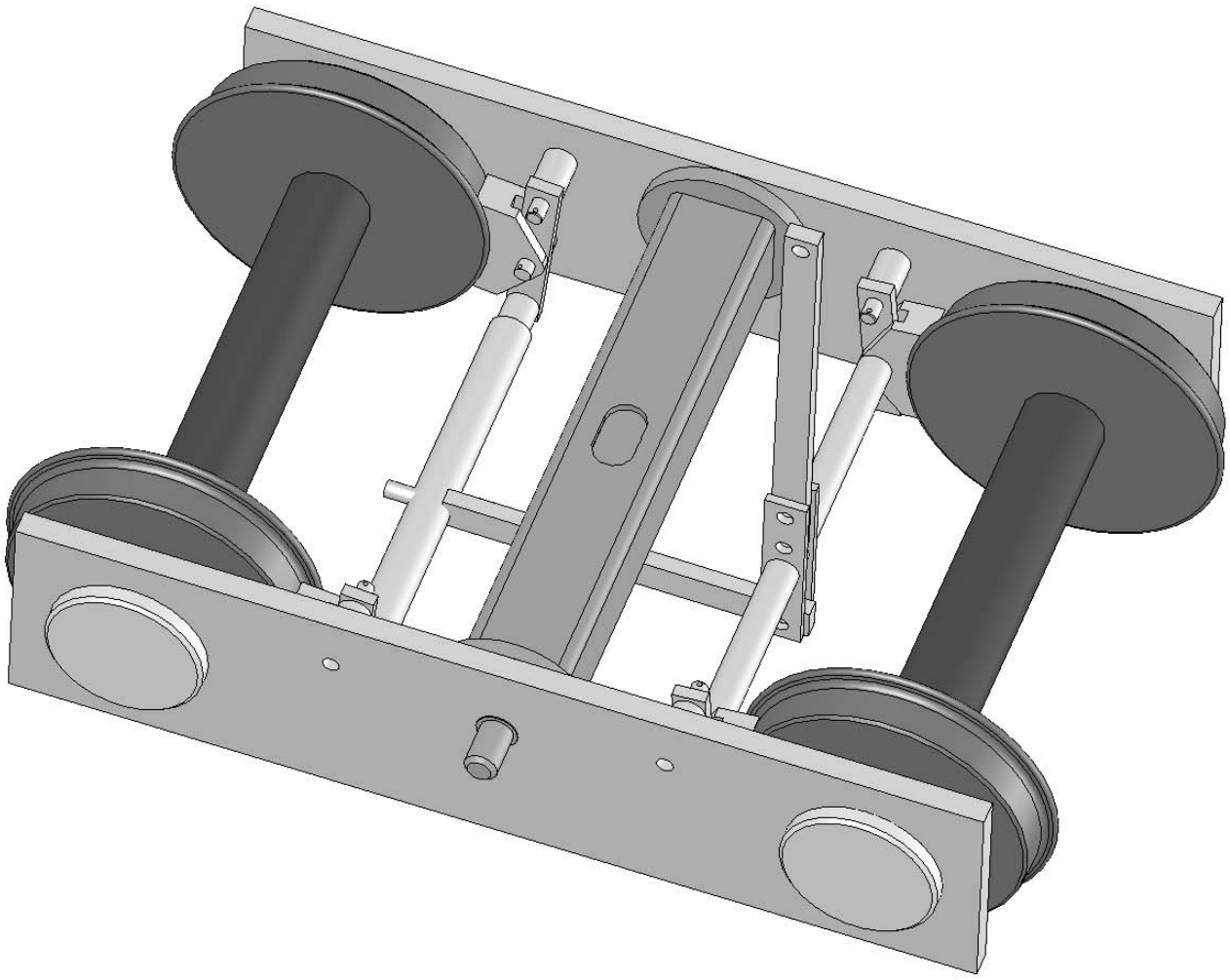
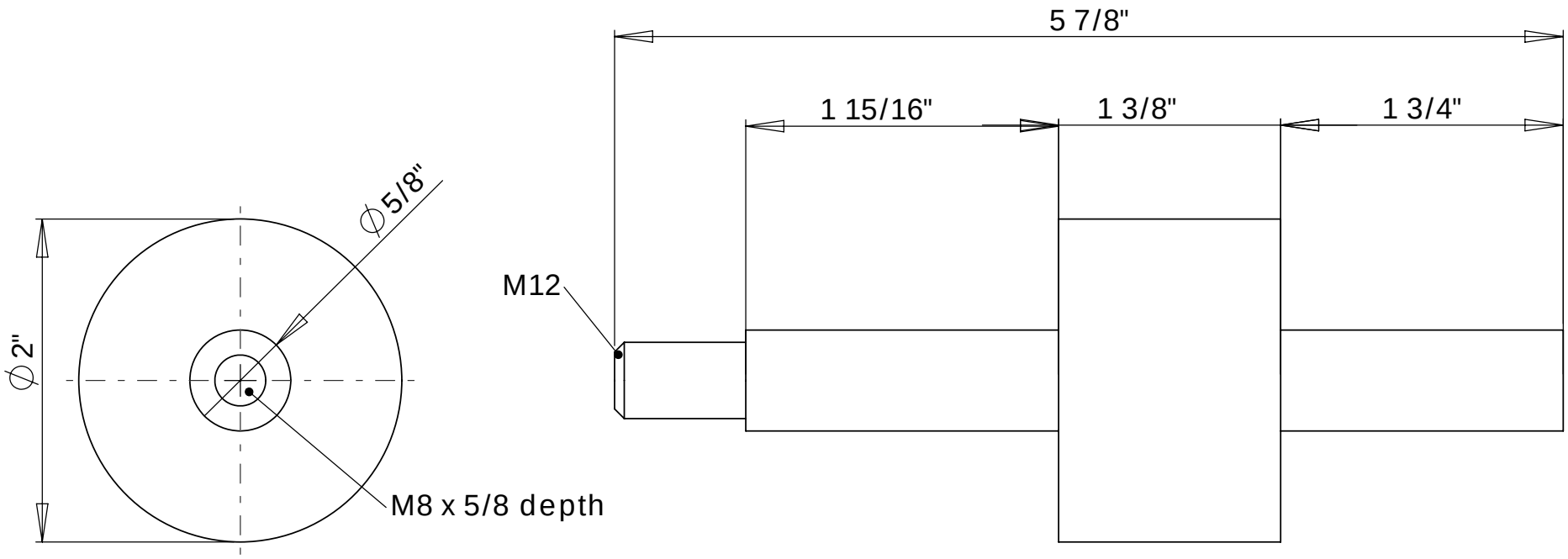
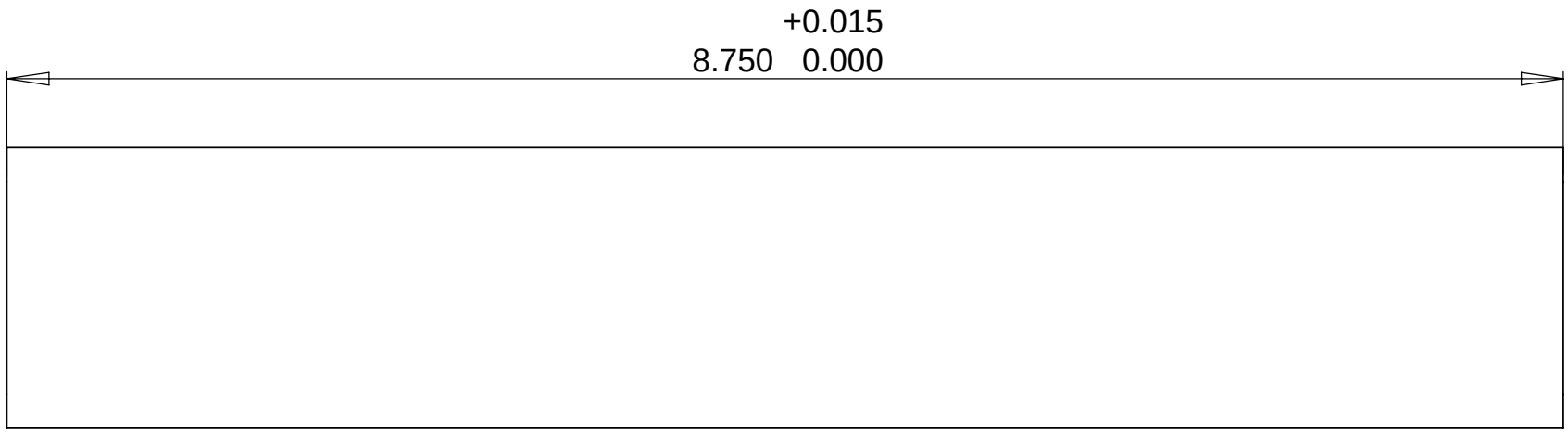


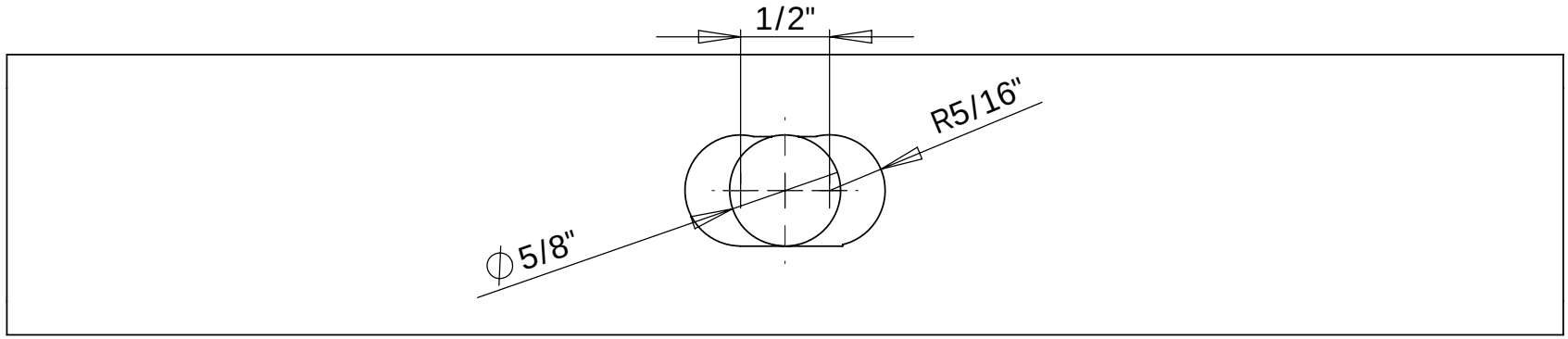
		FINISH:		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION	
					4 - off per car		
	NAME	SIGNATURE	DATE				TITLE:
DRAWN	J Styles		12/5/07				
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL: Mild Steel	DWG NO. body stretcher end		A4
				WEIGHT:	SCALE:1:2	SHEET 1 OF 1	

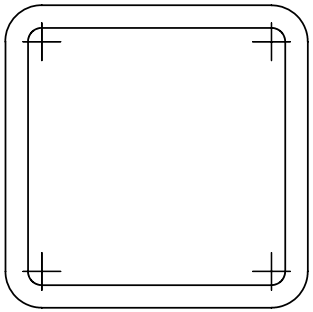




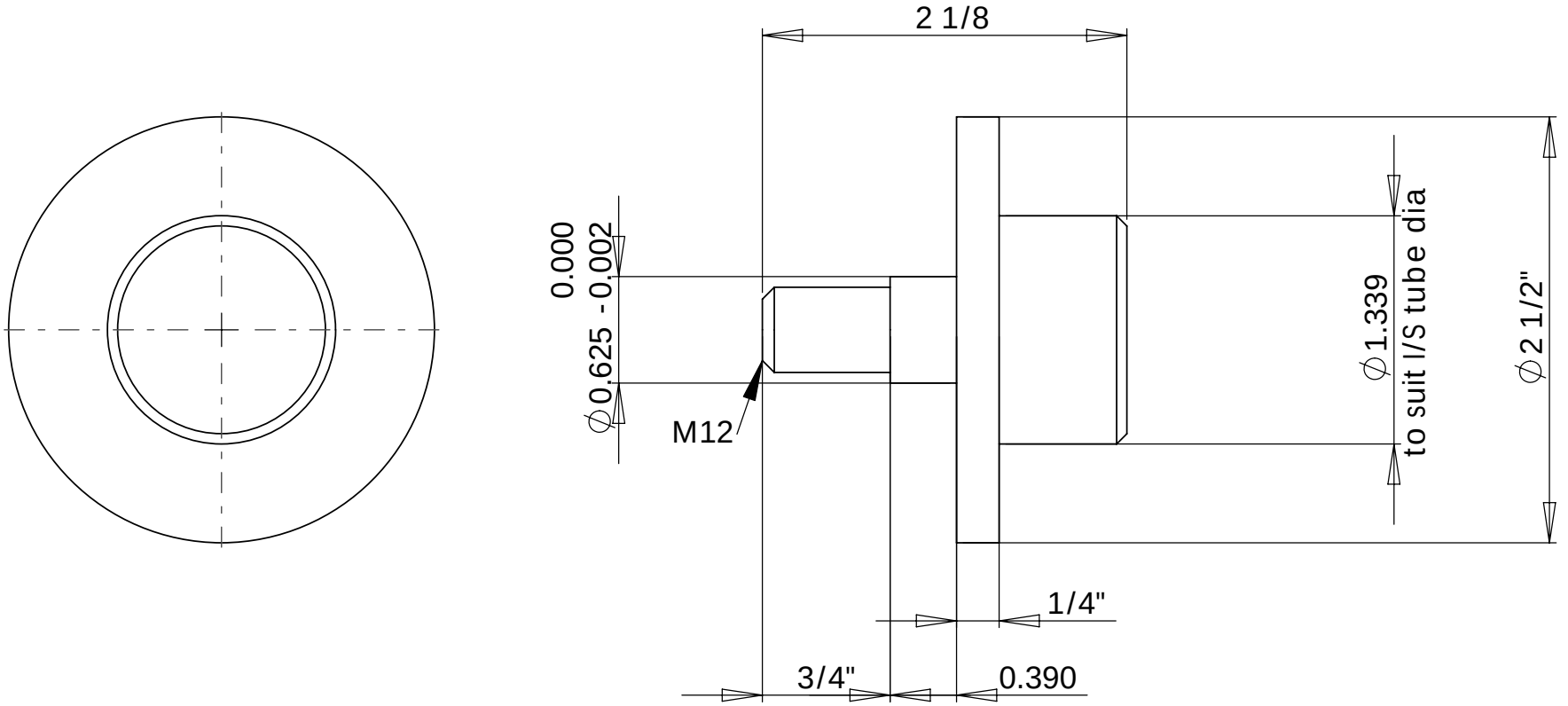
		FINISH: paint exposed parts black		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					2 -off per car	
	NAME	SIGNATURE	DATE			
DRAWN	j Styles		12/5/07		TITLE: MILD STEEL	
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: Mild Steel	DWG NO. bogie pivot	A4
				WEIGHT:	SCALE:1:2	SHEET 1 OF 1



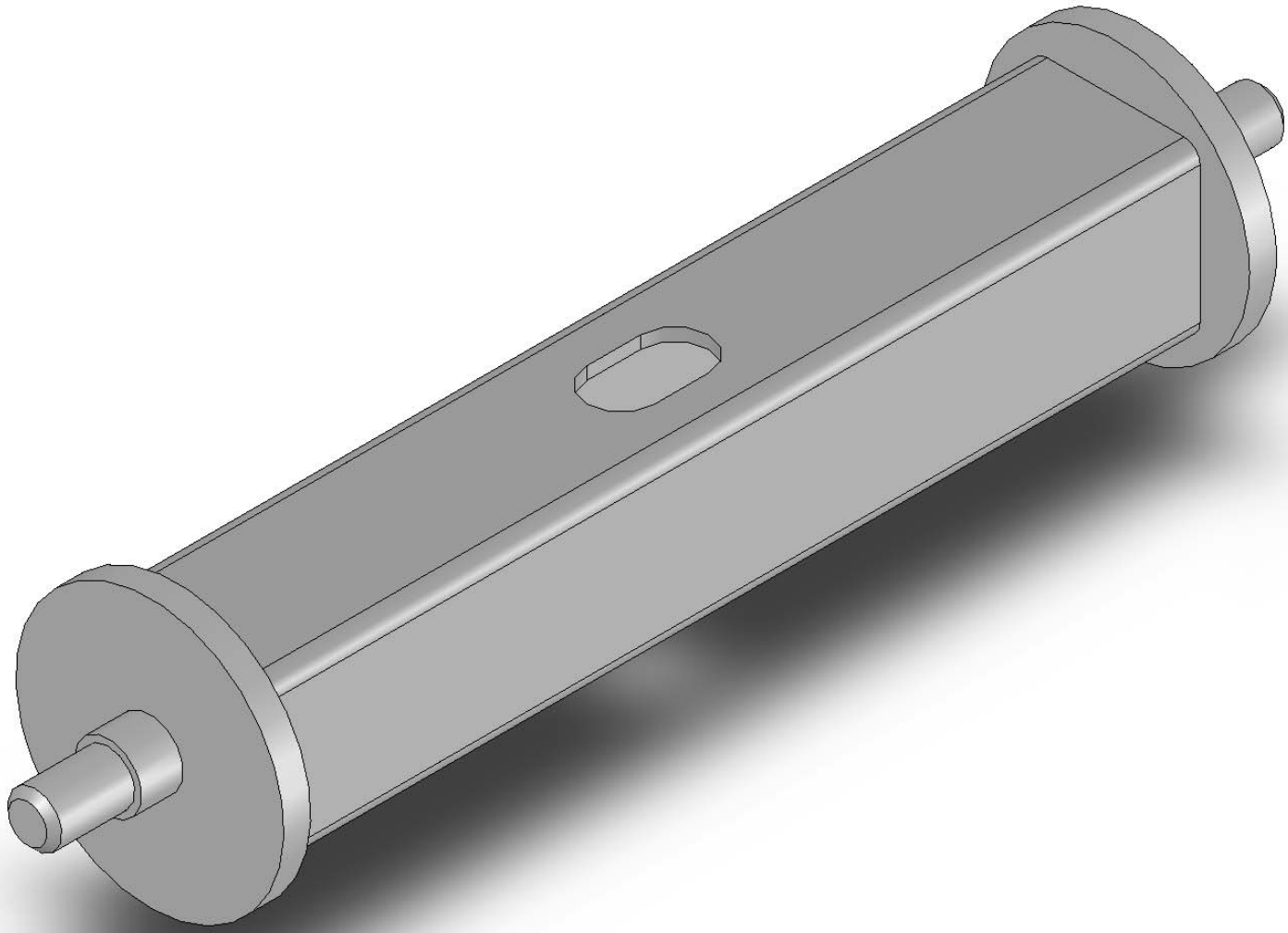




		FINISH:		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					2 per car	
	NAME	SIGNATURE	DATE		TITLE:	
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: SQUARE HOLLOW SECTION 40mm x 40mm x 3mm wall	DWG NO. bogie stretcher	A4
				WEIGHT:	SCALE:1:5	SHEET 1 OF 1



		FINISH:		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION	
					4 - off per car		
	NAME	SIGNATURE	DATE			TITLE:	
DRAWN	J Styles		12/5/07			MILD STEEL	
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL: Mild Steel		DWG NO. bogie stretcher ends	A4
				WEIGHT:		SCALE:1:1	SHEET 1 OF 1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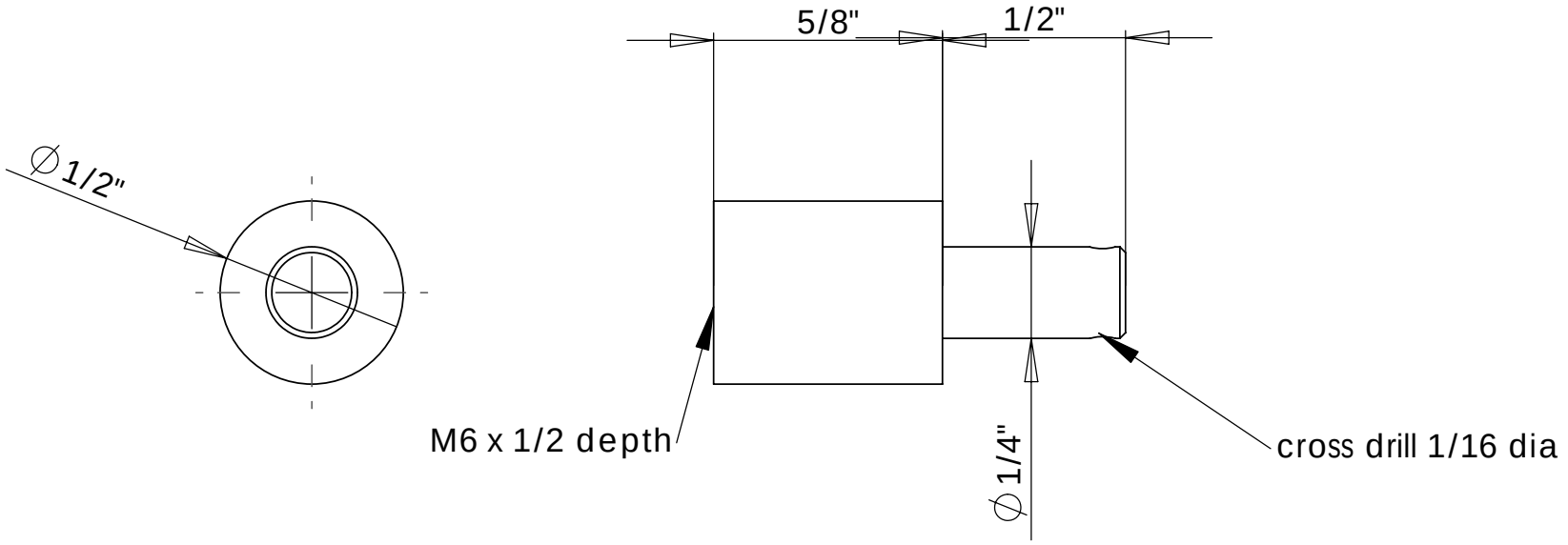
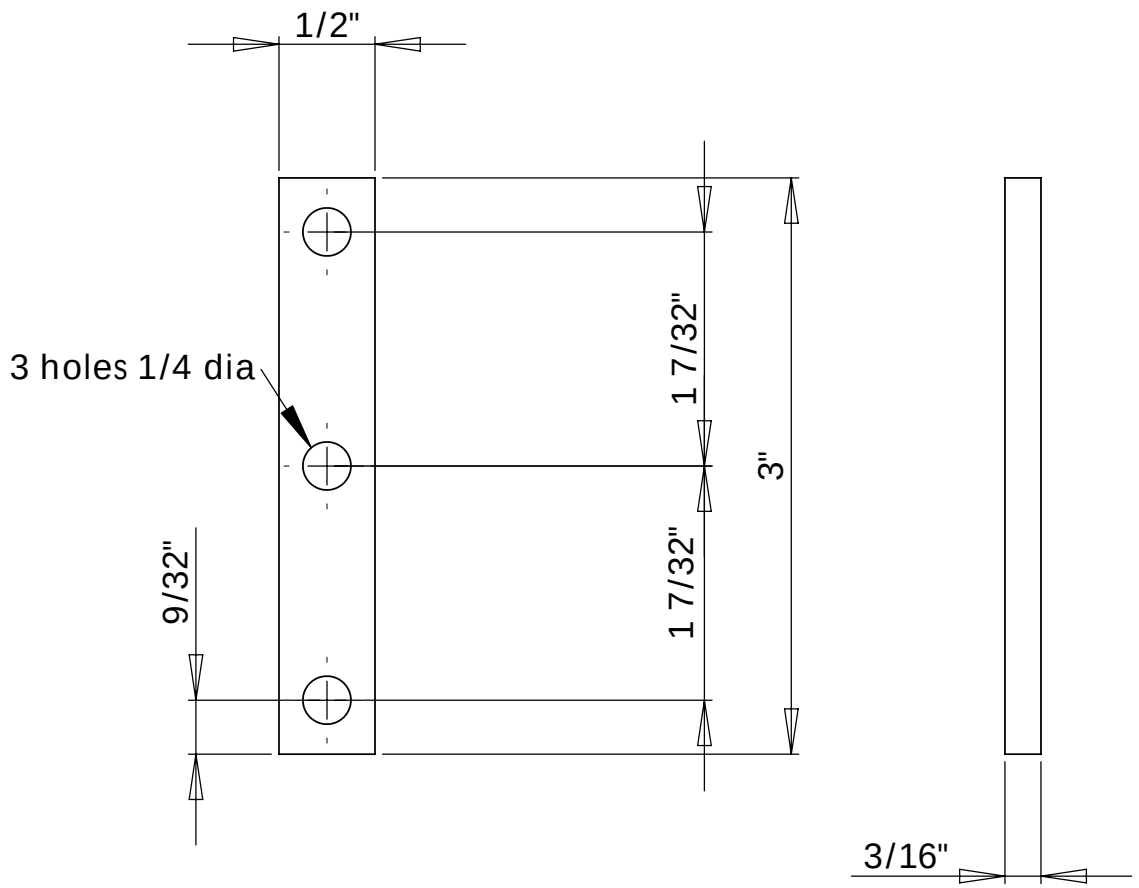
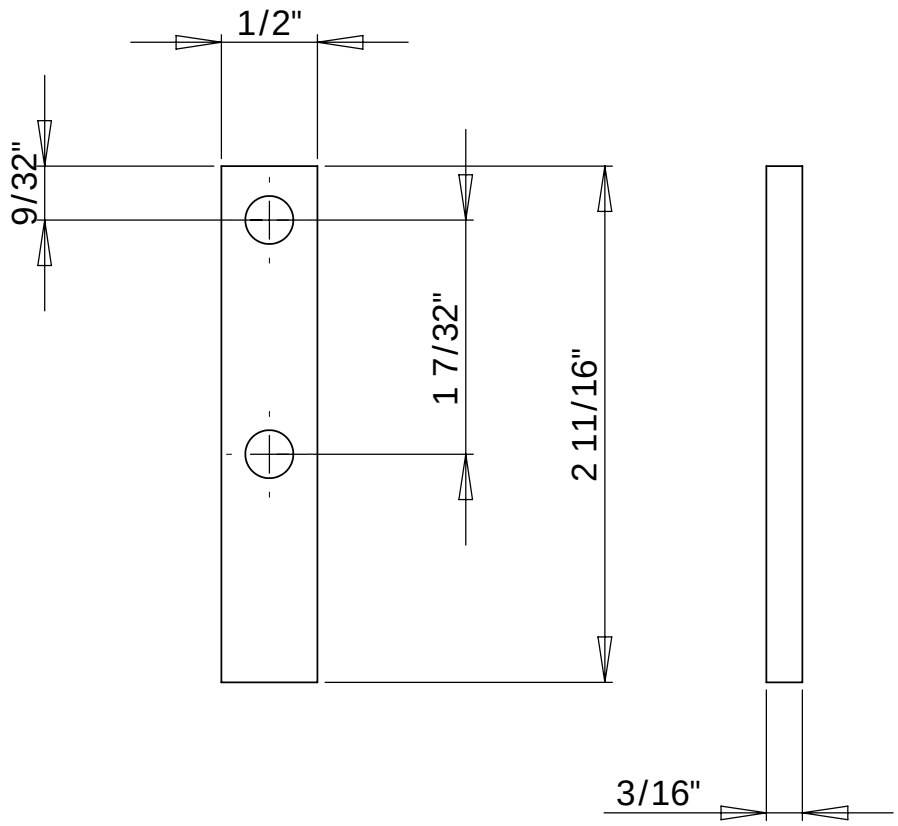


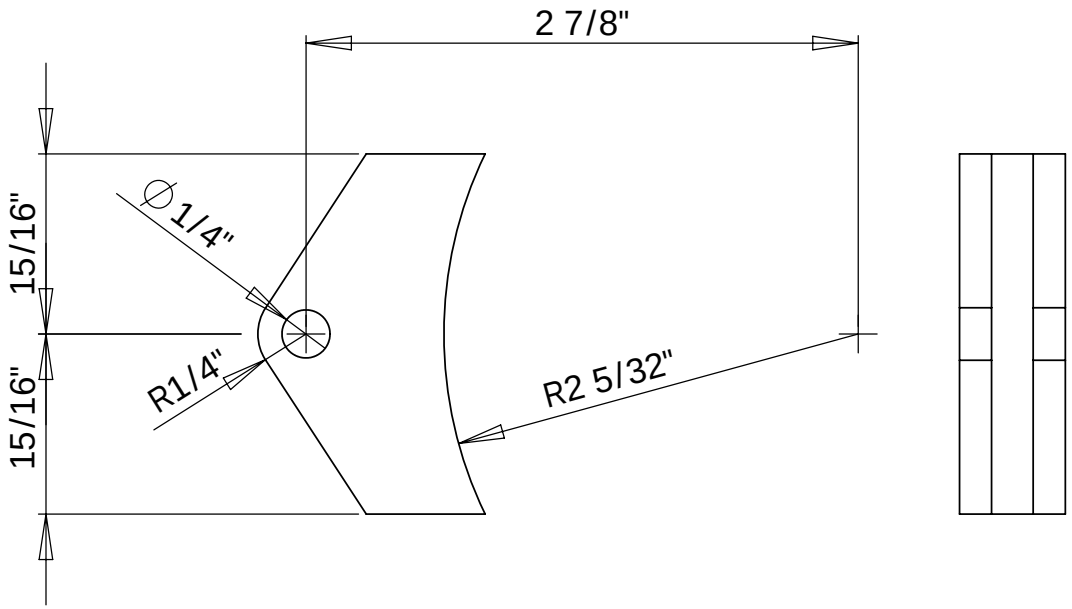
			FINISH: paint black		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
						8 - off per car	
	NAME	SIGNATURE	DATE			TITLE:	
DRAWN	J Styles		12/5/07				
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL: Mild Steel		DWG NO. brake pin	A4
				WEIGHT:		SCALE:2:1	SHEET 1 OF 1

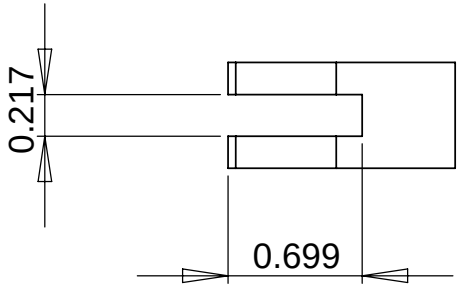


UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	FINISH: Natural				DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING / REVISION: 4 - off per car
	NAME	SIGNATURE	DATE			TITLE:
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: mild steel		DWG NO. brk lever 1 / A4
				WEIGHT:		SCALE:1:1 / SHEET 1 OF 1

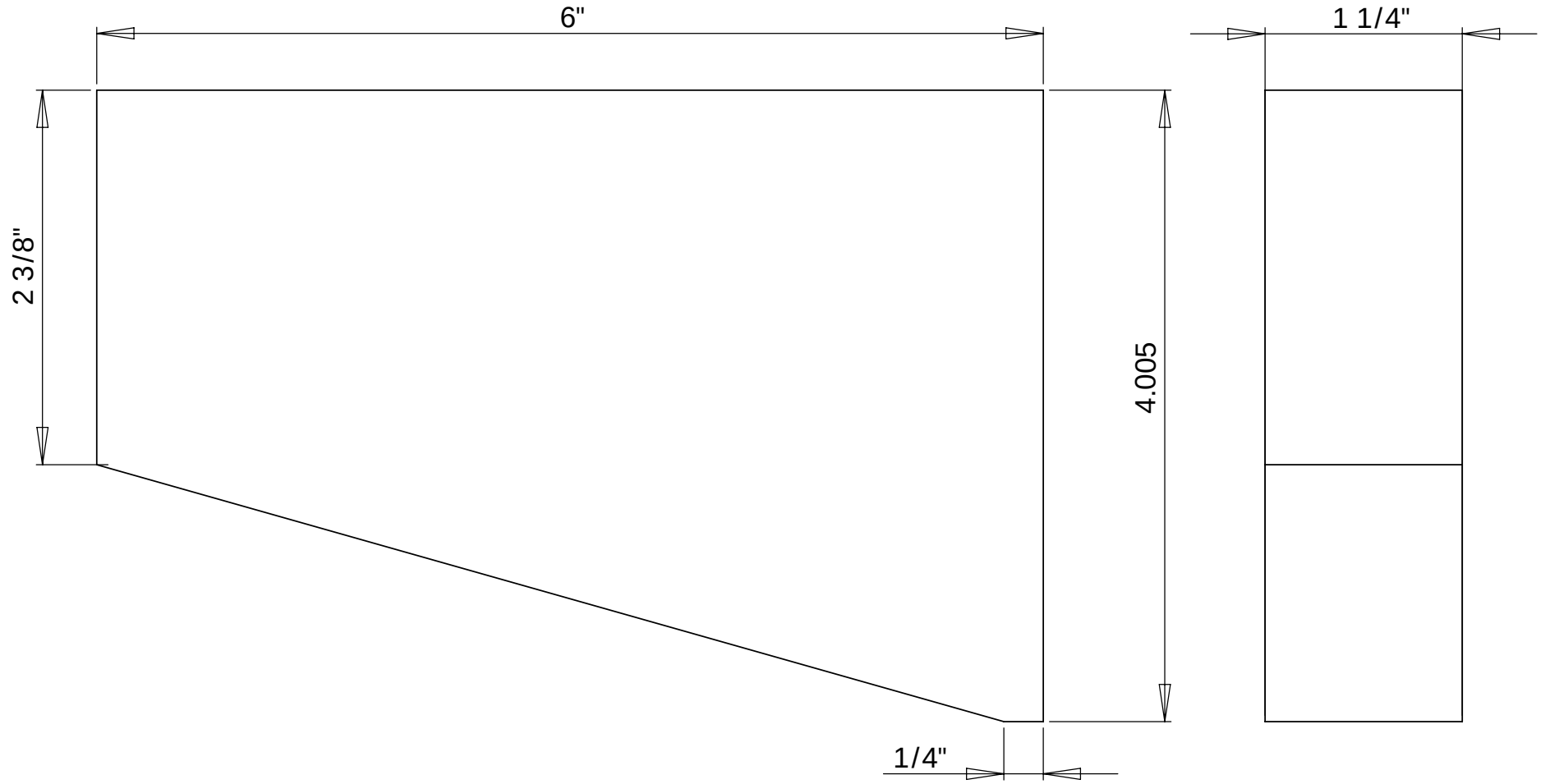


		FINISH: Natural		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					4 - off per car	
	NAME	SIGNATURE	DATE		TITLE:	
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG					MILD STEEL	
Q.A				MATERIAL: Mild steel	DWG NO. brk lever 2	A4
				WEIGHT:	SCALE:1:1	SHEET 1 OF 1

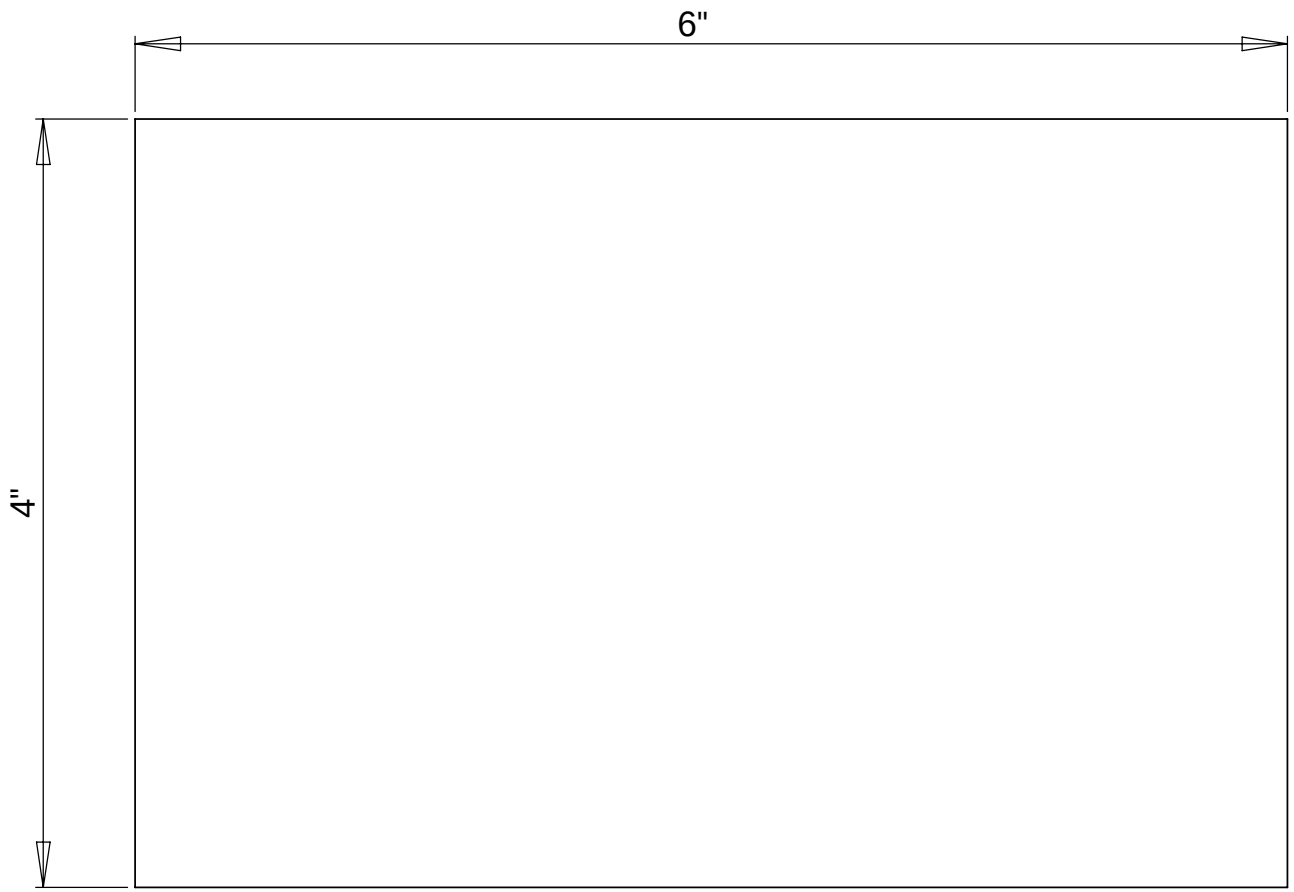


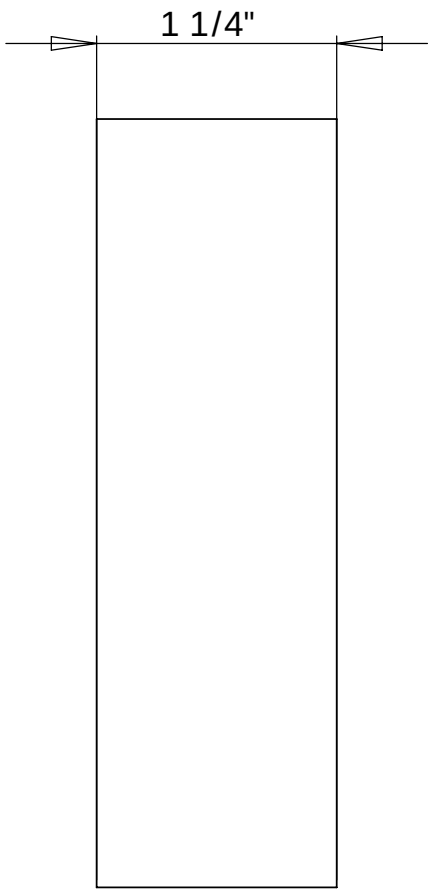


		FINISH:		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					8 - off per car	
	NAME	SIGNATURE	DATE		TITLE: pnp railways Standard Plastic shoes	
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL:	DWG NO. BRAKE SHOE	A4
				WEIGHT:	SCALE:1:1	SHEET 1 OF 1

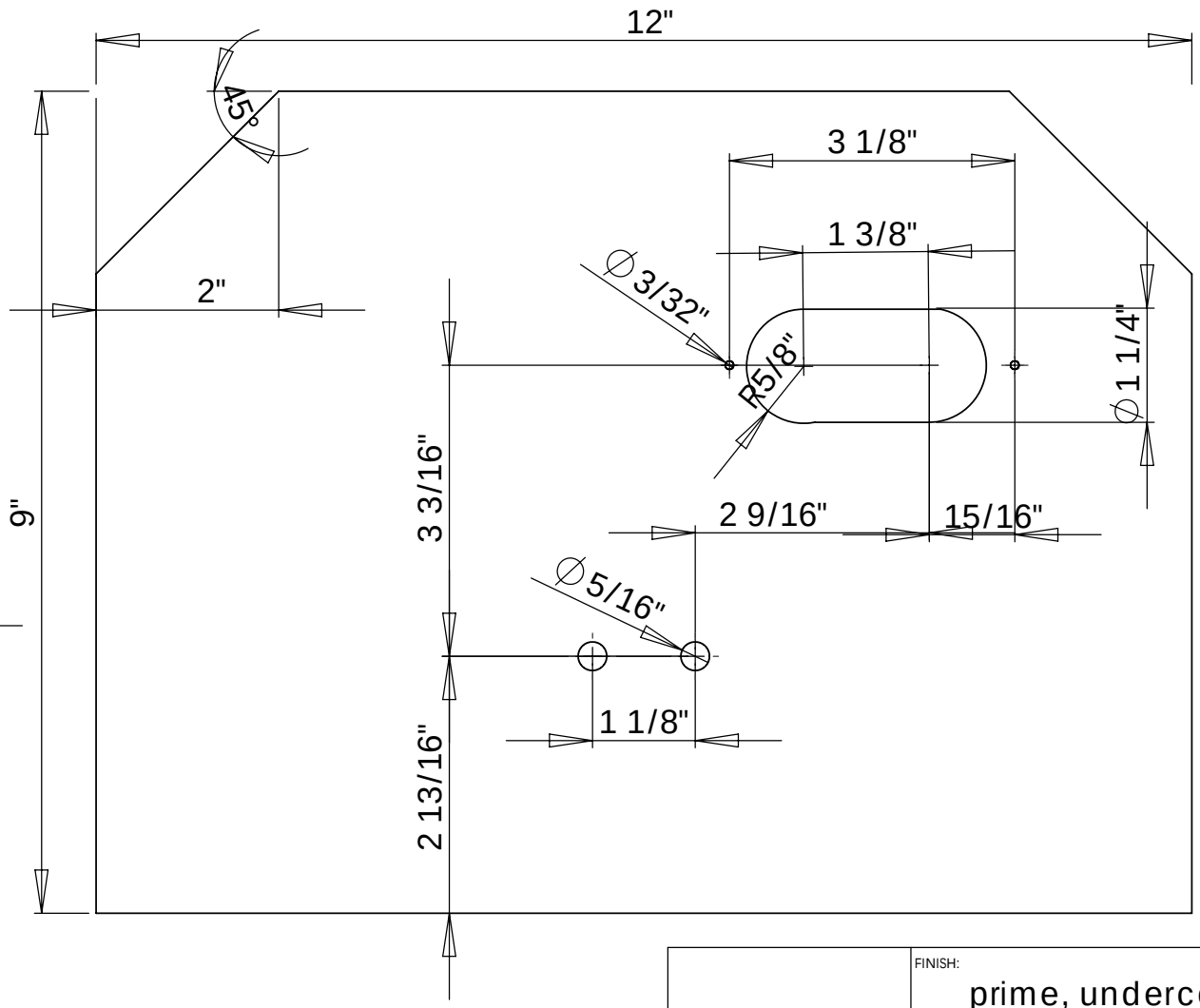


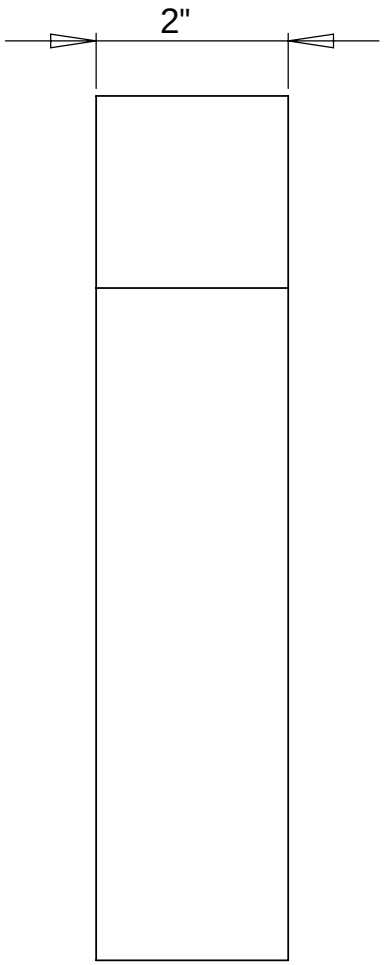
		FINISH: finish with sadolin Teak				DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING / REVISION: 2 -off per car
	NAME	SIGNATURE	DATE				TITLE:
DRAWN	J Styles		12/5/07				
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL: Wood			DWG NO. buffer back / A4
				WEIGHT:			SCALE:1:2 / SHEET 1 OF 1



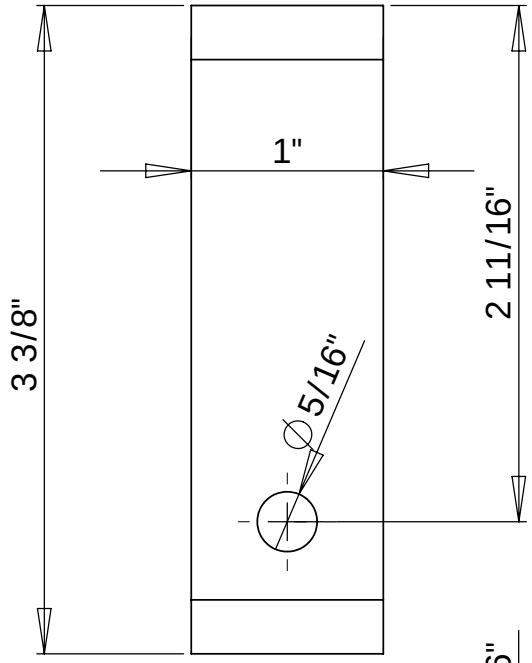


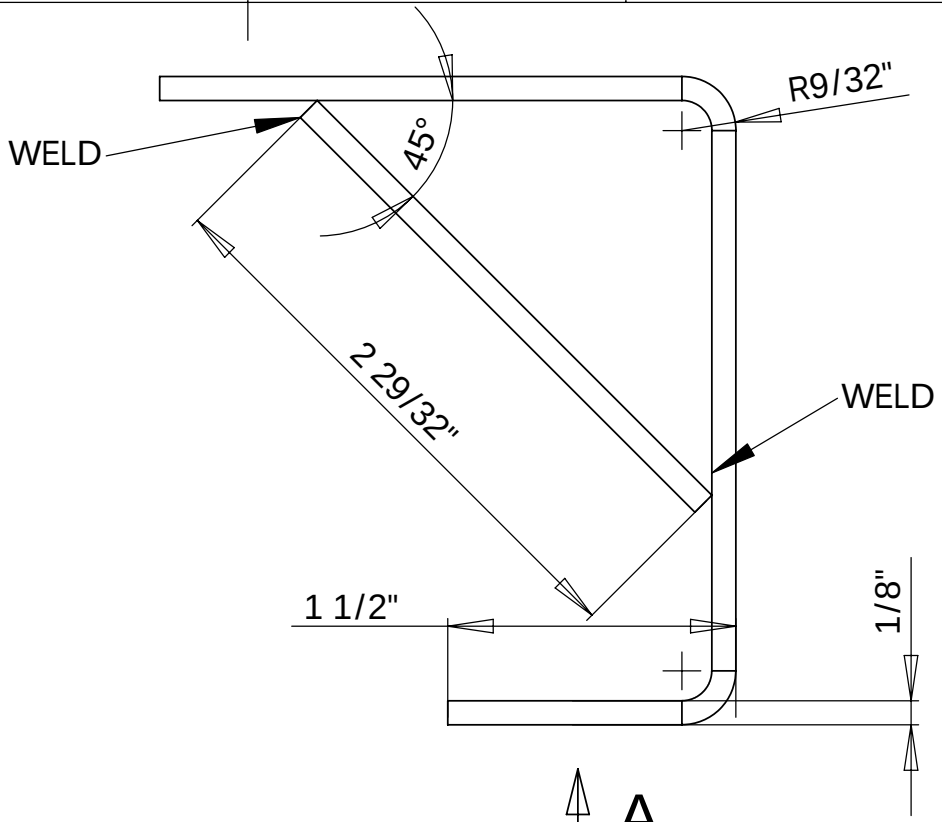
		FINISH: finish in sadliin teak			DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING / REVISION
						2 -off per car
	NAME	SIGNATURE	DATE			TITLE:
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: wood		DWG NO. buffer front / A4
				WEIGHT:		SCALE:1:2 / SHEET 1 OF 1

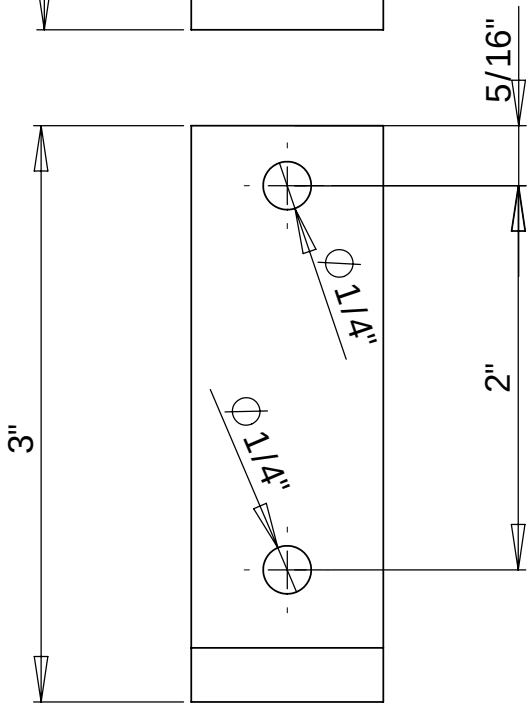


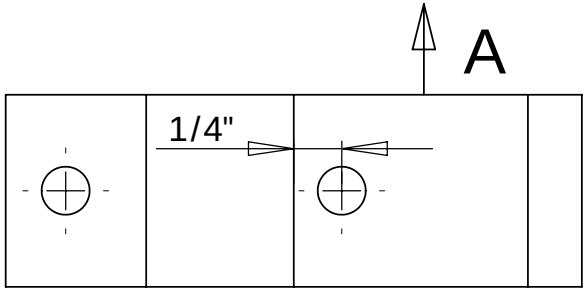


		FINISH: prime, undercoat finish yellow gloss		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					2 -off per car	
	NAME	SIGNATURE	DATE			TITLE:
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: WOOD	DWG NO. car end wood	A4
				WEIGHT:	SCALE:1:5	SHEET 1 OF 1

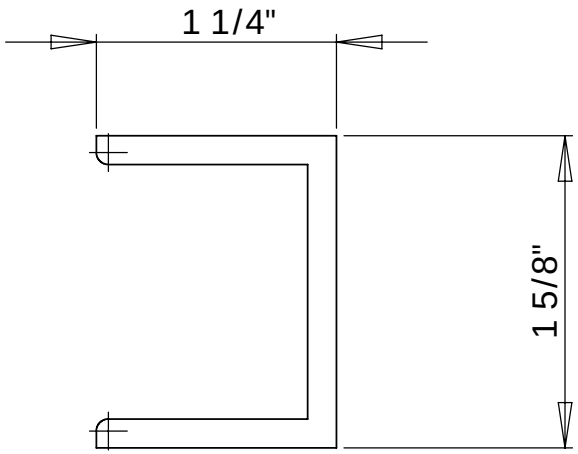


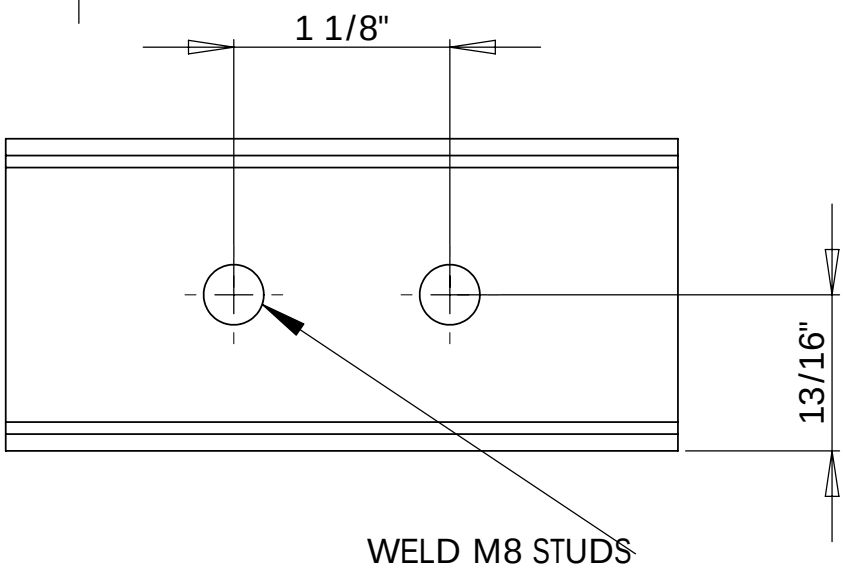


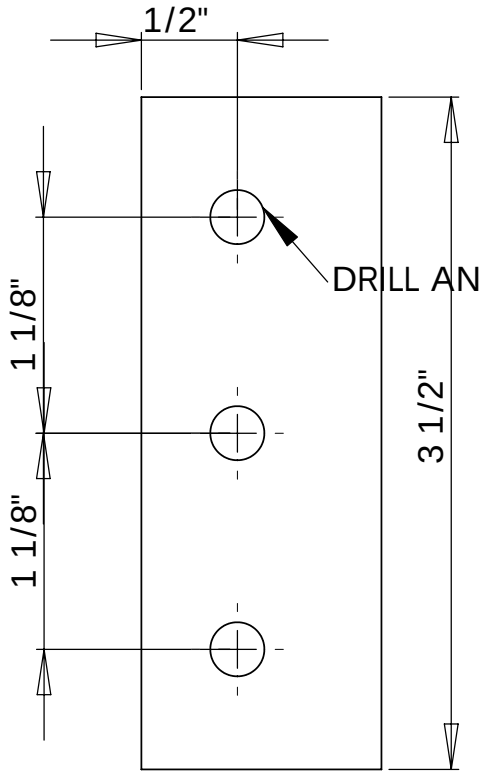




		FINISH: paint black		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					1 - off per car	
	NAME	SIGNATURE	DATE			TITLE:
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: Mild Steel	DWG NO. cylinder bracket	A4
				WEIGHT:	SCALE:1:1	SHEET 1 OF 1







		FINISH: Natural			DEBUR AND BREAK SHARP EDGES	
	NAME	SIGNATURE	DATE			
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: Mild Steel		
				WEIGHT:		

DO NOT SCALE DRAWING | REVISION

2 - off per car 2nd edition

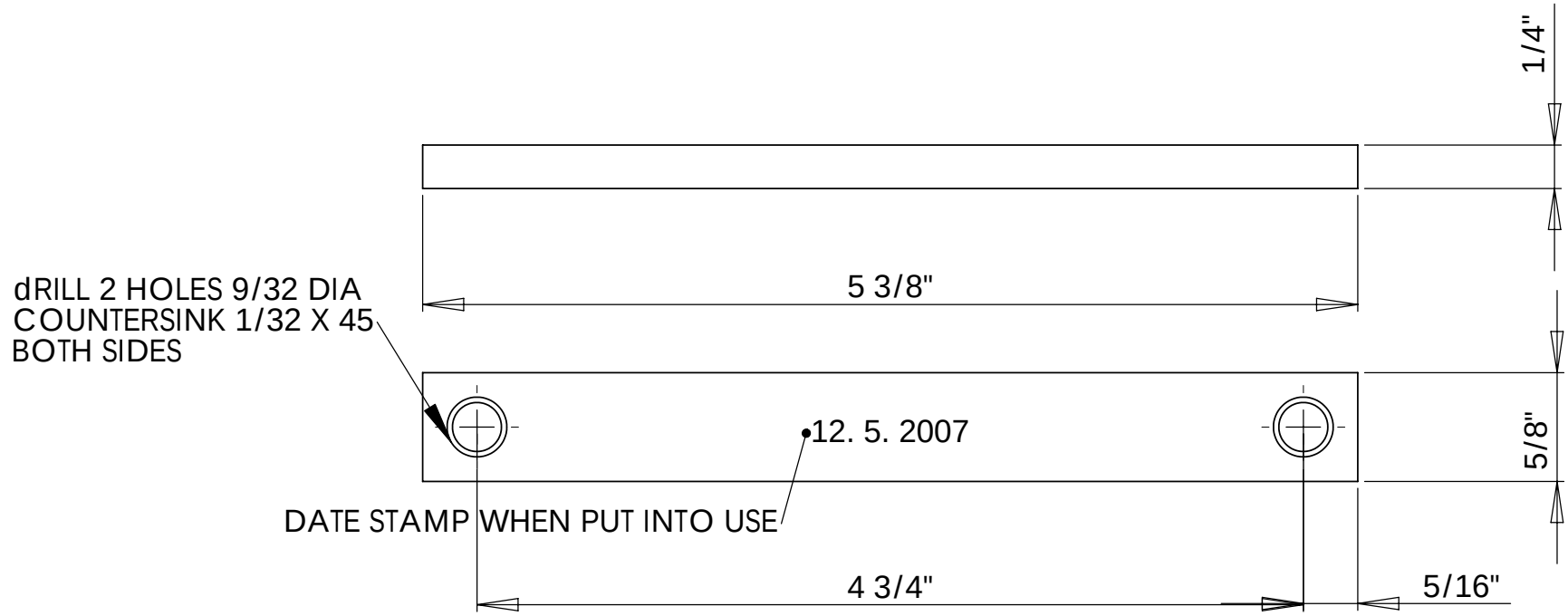
1 - off per car modified

TITLE: SIGNAL RODDING

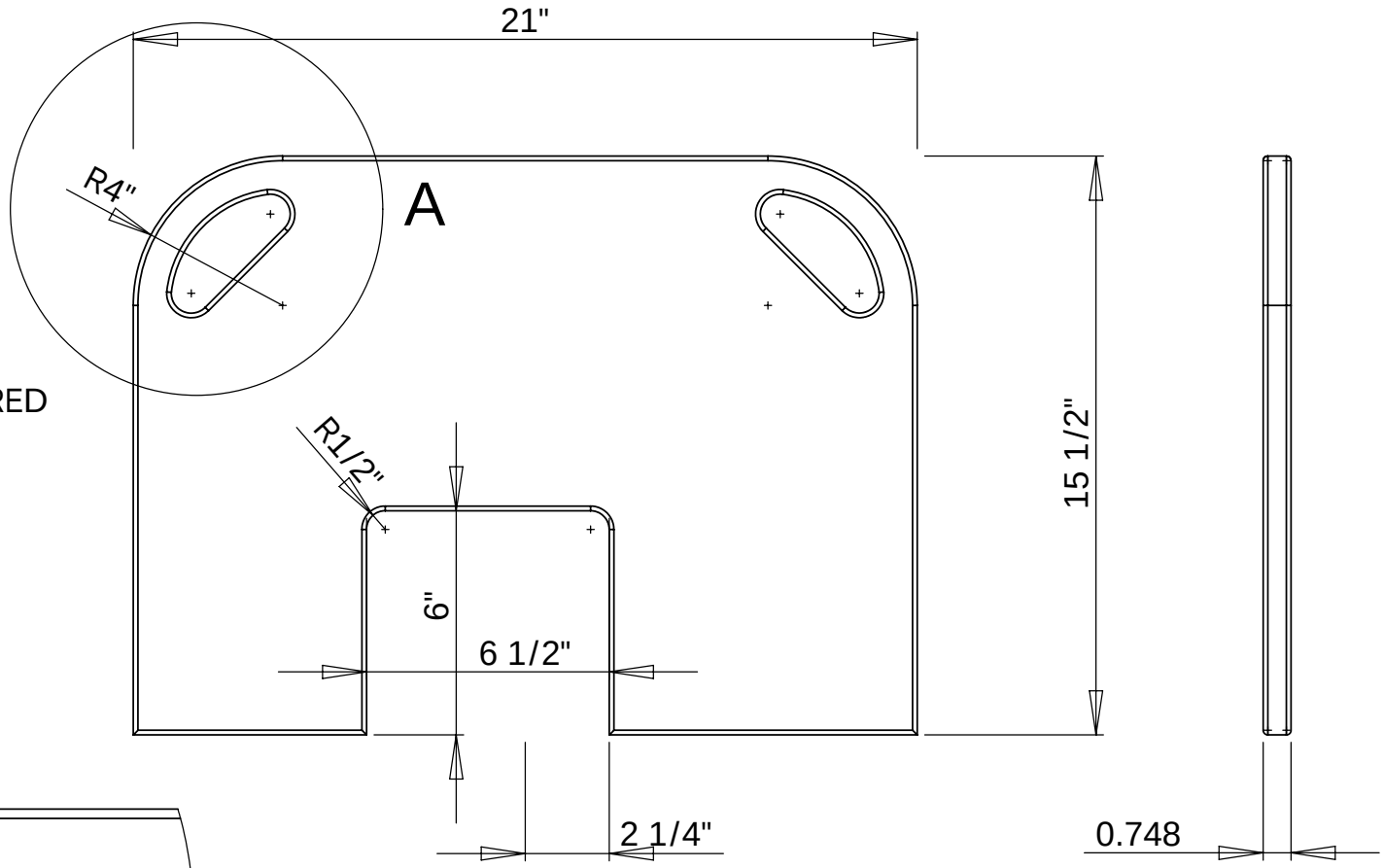
DWG NO. draw bracket

A4

SCALE:1:1 | SHEET 1 OF 1

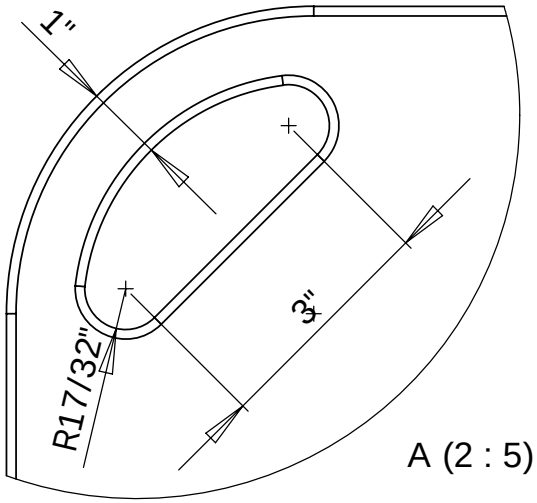


		FINISH: natural		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
	NAME	SIGNATURE	DATE			
DRAWN	j styles		12/5/07		TITLE: 1 - off per car	
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: MILD STEEL	DWG NO. drawbar	A4
				WEIGHT:	SCALE:1:2	SHEET 1 OF 1



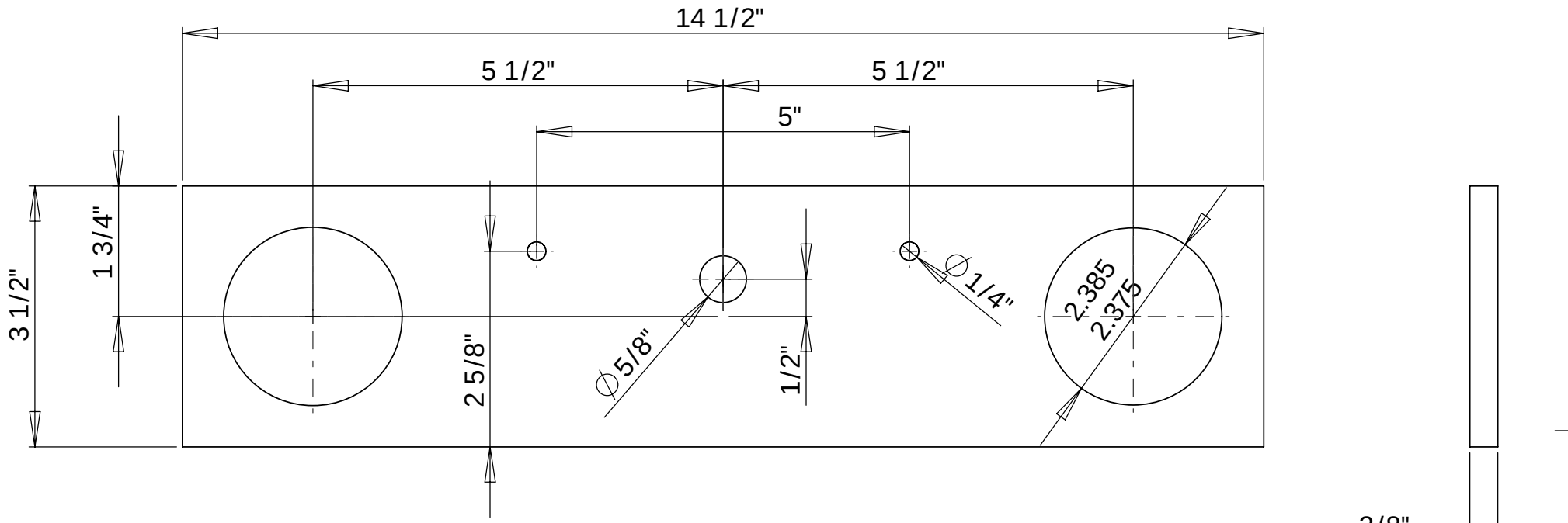
ALL EDGES ROUTERED
WITH 1/8 RADIUS

FINISH IN TEAK
SADOLIN

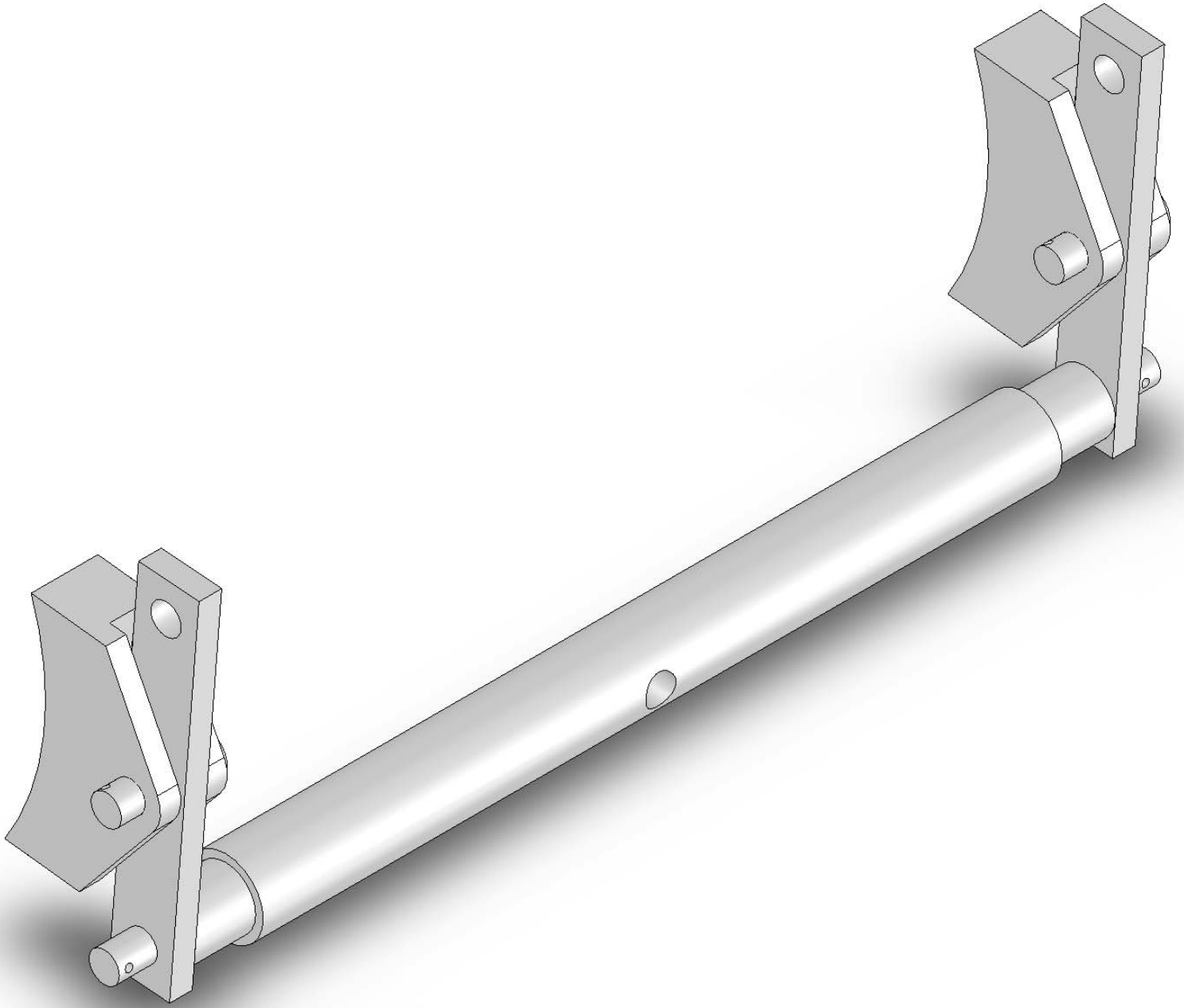


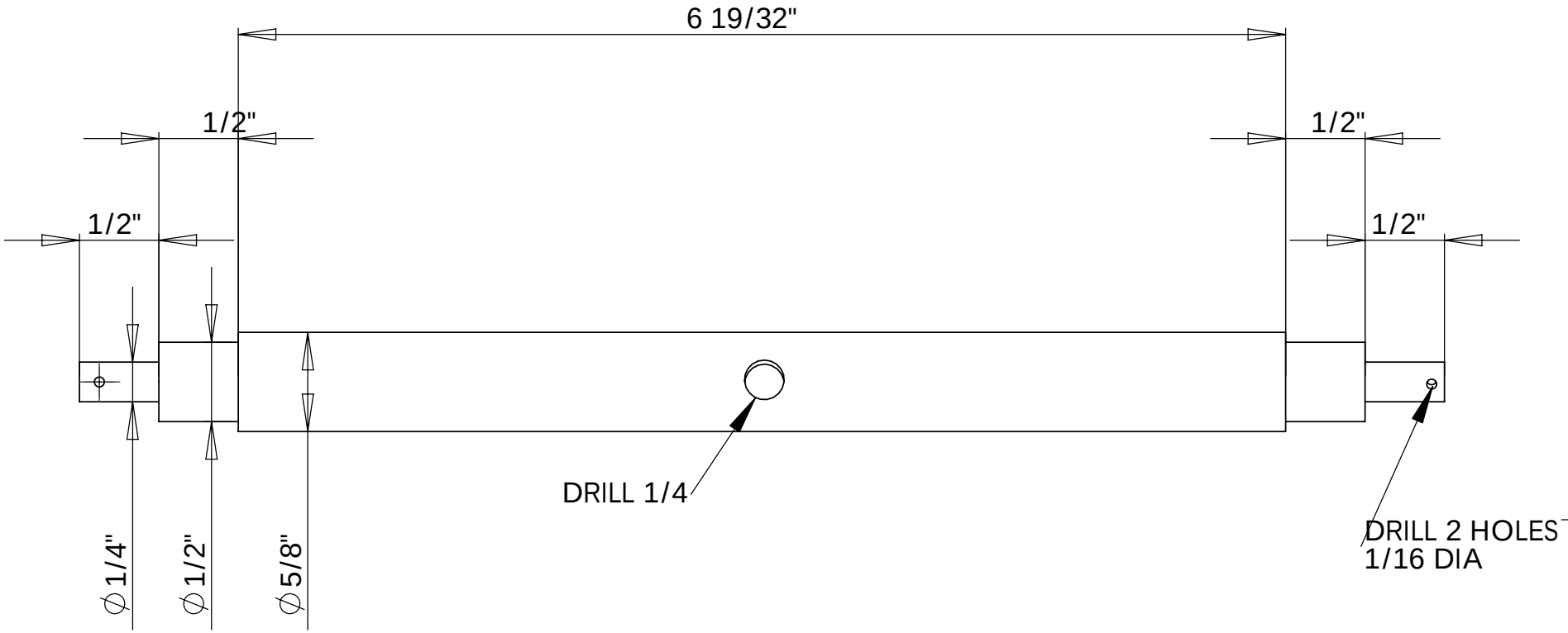
A (2 : 5)

		FINISH: 2 coats of teak Sadolin		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					2 - off per car	
	NAME	SIGNATURE	DATE		TITLE:	
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: 20mm Smooth face ply	DWG NO. endboard	A4
				WEIGHT:	SCALE:1:5	SHEET 1 OF 1

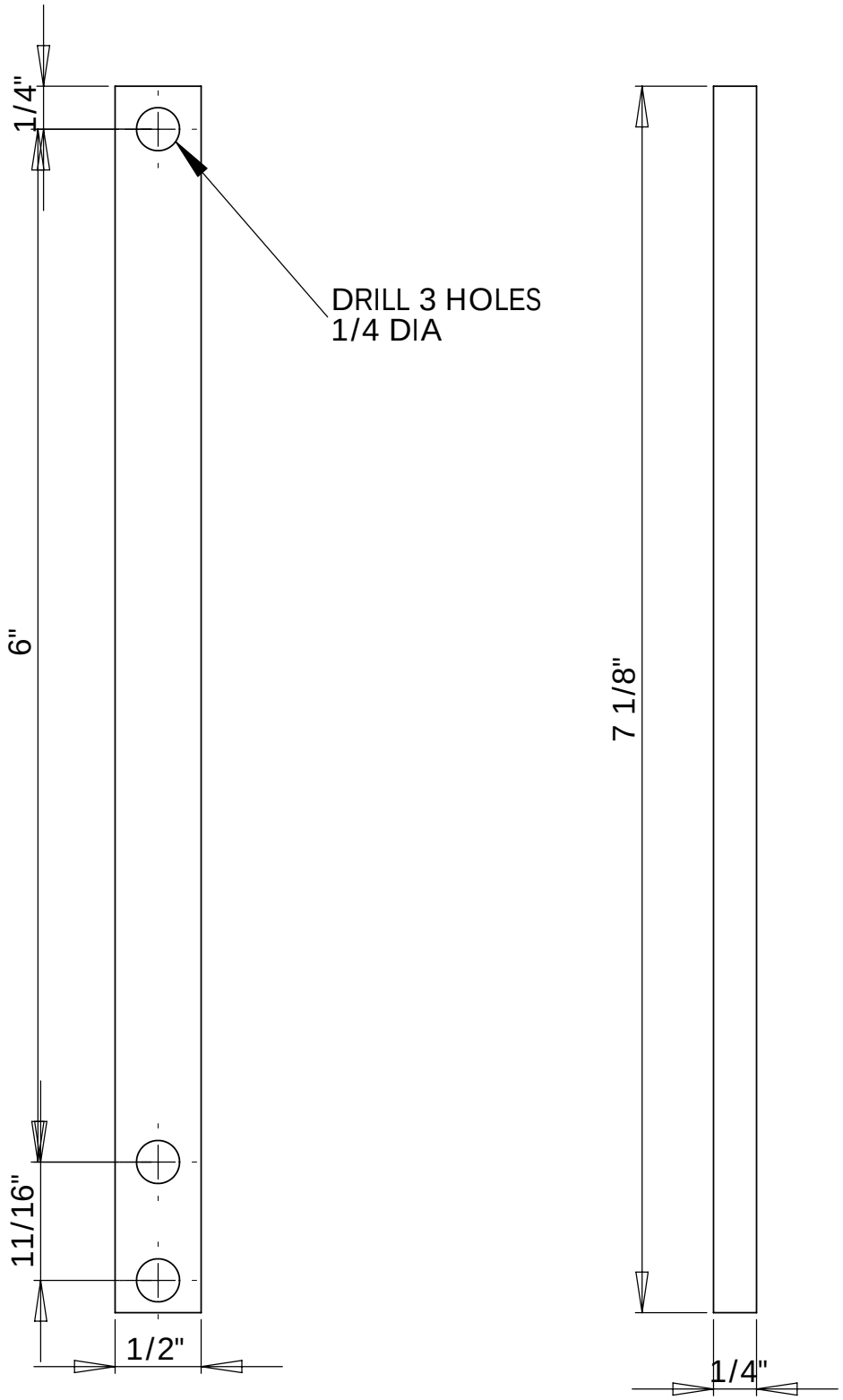


			FINISH: Paint Black		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
						4 - off per car	
	NAME	SIGNATURE	DATE			TITLE:	
DRAWN	J Styles		12/5/07				
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL: Mild Steel		DWG NO. frame	A4
				WEIGHT:		SCALE:1:5	SHEET 1 OF 1

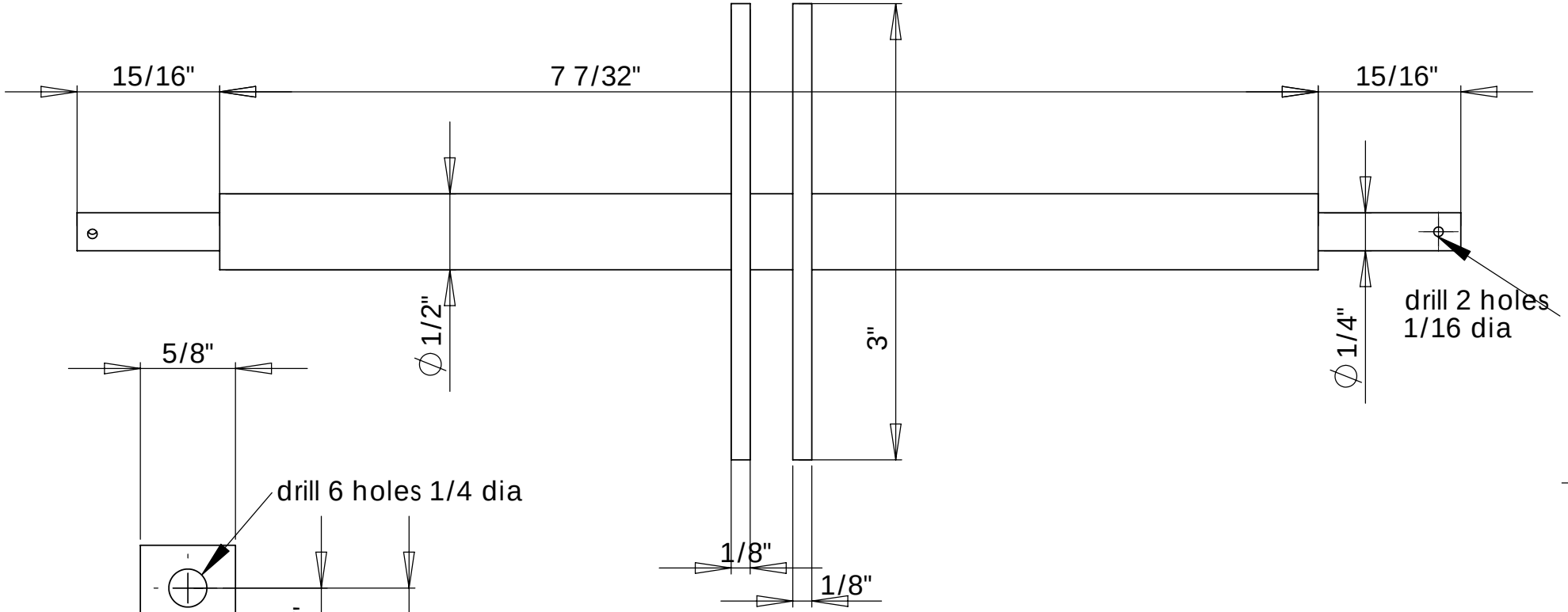

Y
Z
X

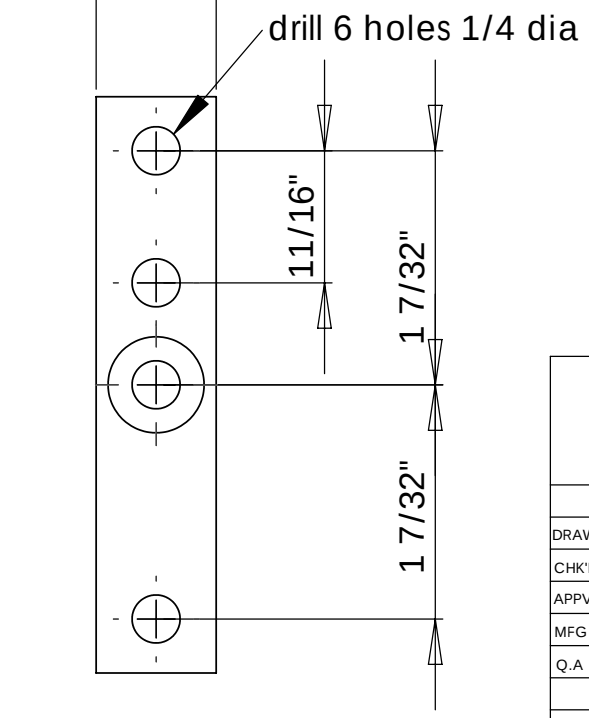


		FINISH: Paint Black		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					2 - off per car	
	NAME	SIGNATURE	DATE			TITLE:
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: Mild Steel	DWG NO. inner beam	A4
				WEIGHT:	SCALE:1:5	SHEET 1 OF 1

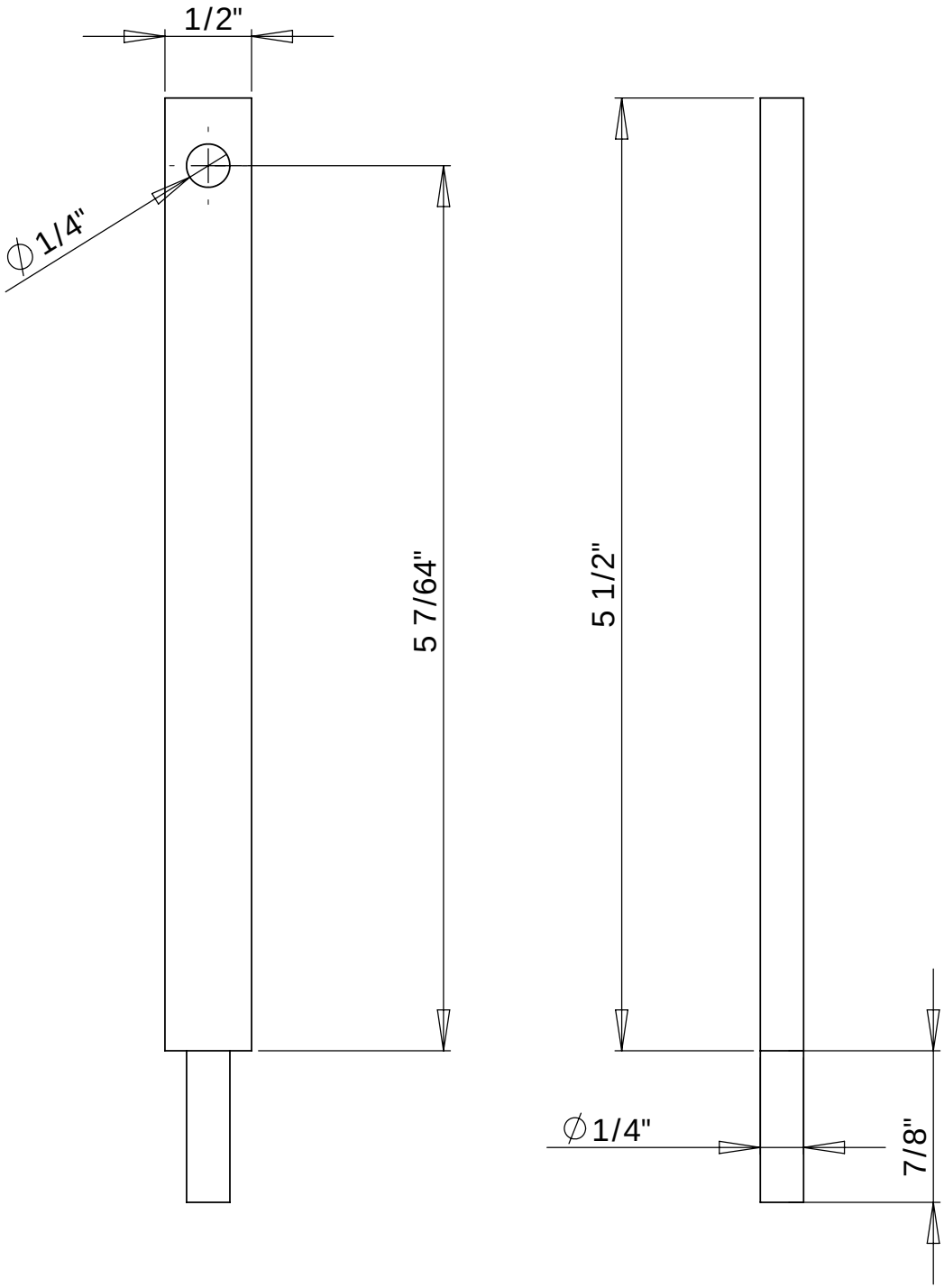


		FINISH: Natural		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					2 - off per car	
	NAME	SIGNATURE	DATE			TITLE:
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: Mild Steel	DWG NO. lever	A4
				WEIGHT:	SCALE:1:2	SHEET 1 OF 1

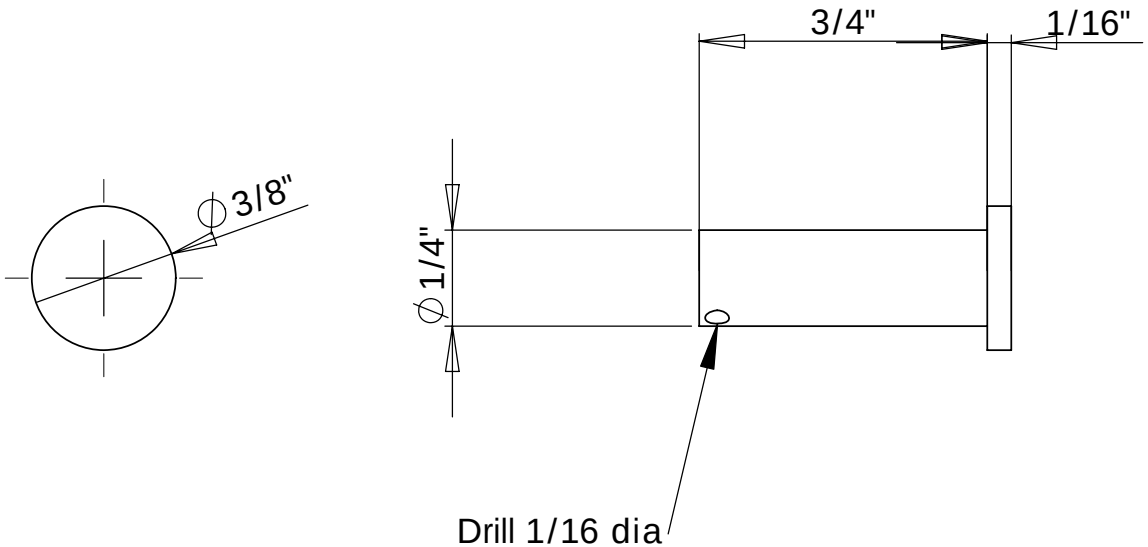




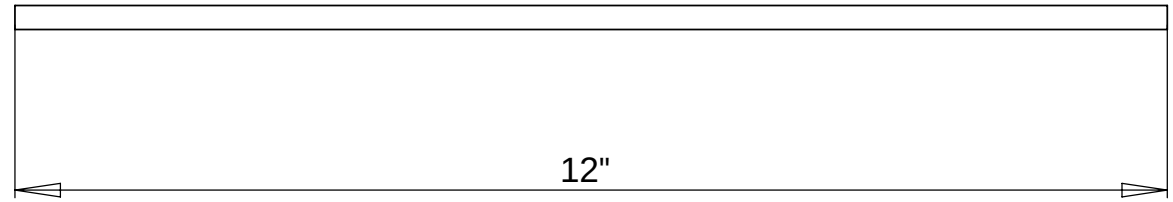
		FINISH: Paint Black		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					1 - off per car	
	NAME	SIGNATURE	DATE		TITLE:	
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: Mild Steel	DWG NO. outer beam	A4
				WEIGHT:	SCALE:1:5	SHEET 1 OF 1



		FINISH: Paint Black		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					1 - per car	
	NAME	SIGNATURE	DATE			TITLE:
DRAWN	J Styles		12/5/07			MILD STEEL
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: Mild Steel	DWG NO.	PUSH ROD A4
				WEIGHT:	SCALE:1:2	SHEET 1 OF 1

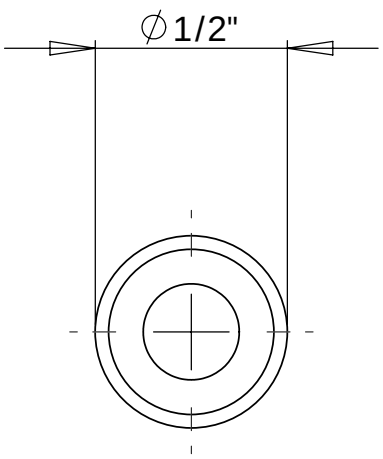


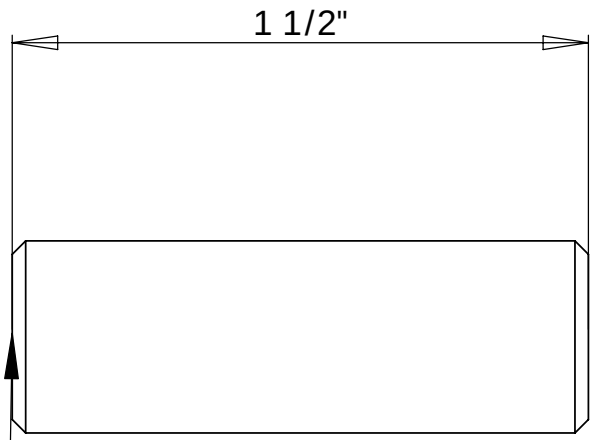
			FINISH: Natural		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
						8 -off per car	
	NAME	SIGNATURE	DATE			TITLE:	
DRAWN	J Styles		12/5/07				
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL: Mild Steel		DWG NO. pivot pin	A4
				WEIGHT:		SCALE:2:1	SHEET 1 OF 1



M6 standard threaded rod (see Material)

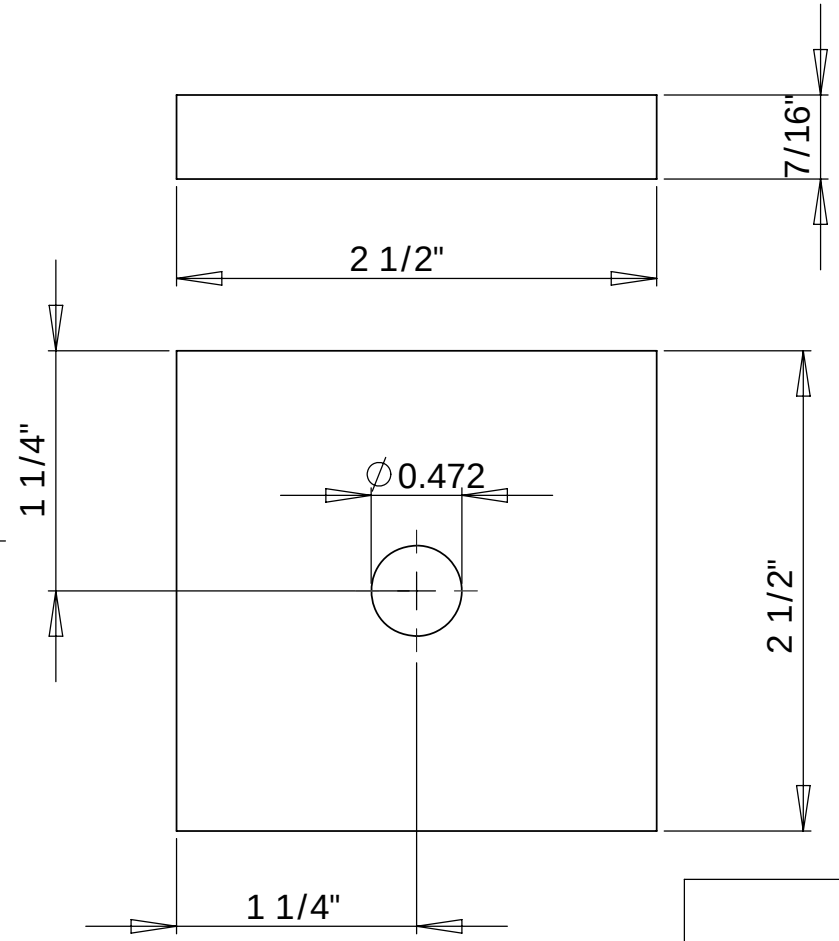
		FINISH: Natural		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					1 - off per car	
	NAME	SIGNATURE	DATE			TITLE:
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: Mild steel Zinc plated or stainless steel	DWG NO. pull rod	A4
				WEIGHT:	SCALE:1:5	SHEET 1 OF 1



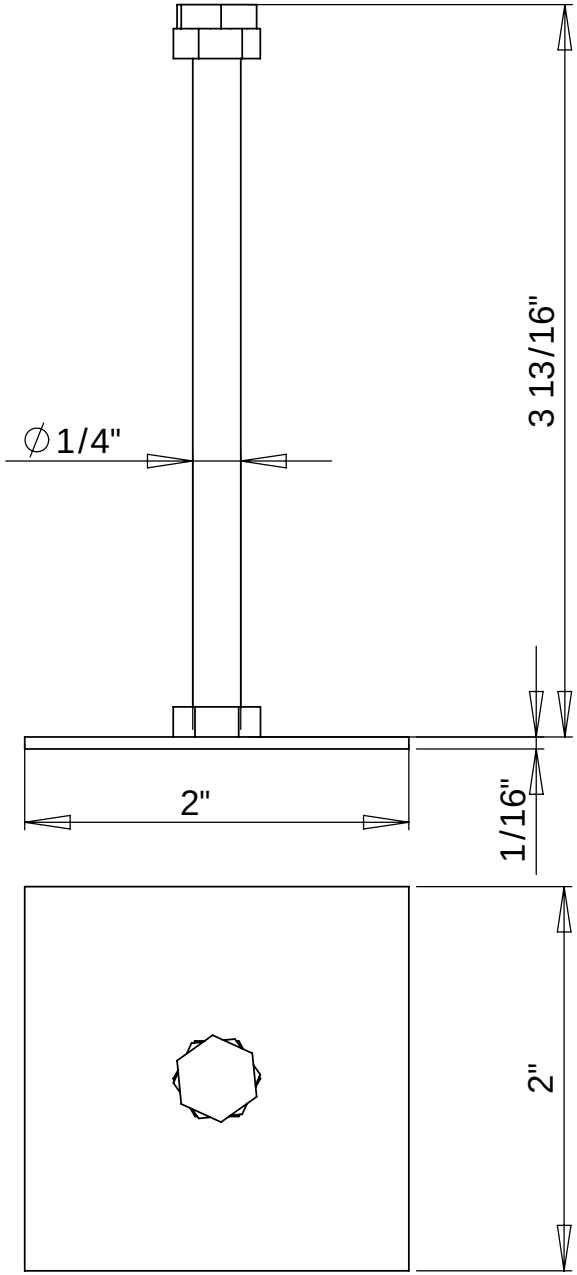


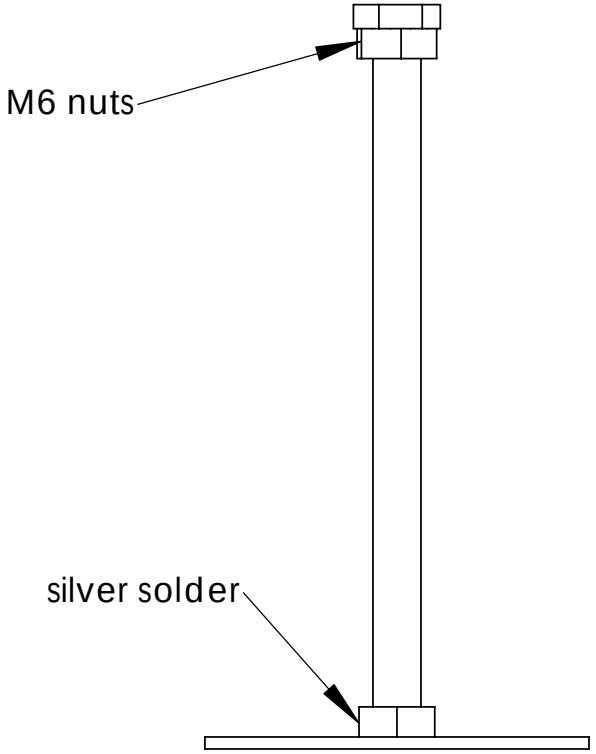
drill & tap M6 X 1/2 IN DEEP
BOTH ENDS

		FINISH: Natural		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					1 - off per car	
	NAME	SIGNATURE	DATE		TITLE: mild steel or brass	
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: Mild Steel	DWG NO. pull rod coupling	A4
				WEIGHT:	SCALE:2:1	SHEET 1 OF 1



		FINISH: Natural		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					8 - off per car 2 in stack	
	NAME	SIGNATURE	DATE			TITLE:
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: Rubber	DWG NO. rubber block	A4
				WEIGHT:	SCALE:1:1	SHEET 1 OF 1





DEBUR AND BREAK SHARP EDGES

DO NOT SCALE DRAWING

REVISION

4 - off per car

TITLE: Drawn J Styles 12/5/07

MATERIAL: ALL MILD STEEL

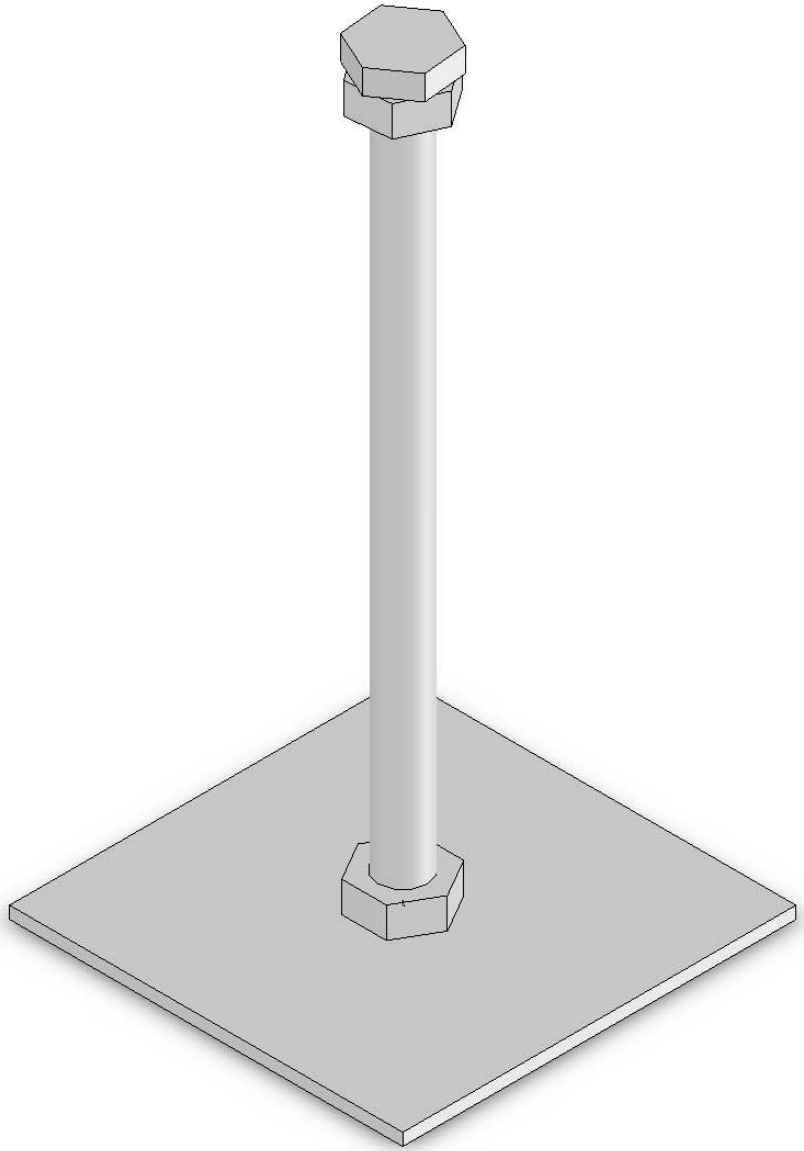
DWG NO. support block

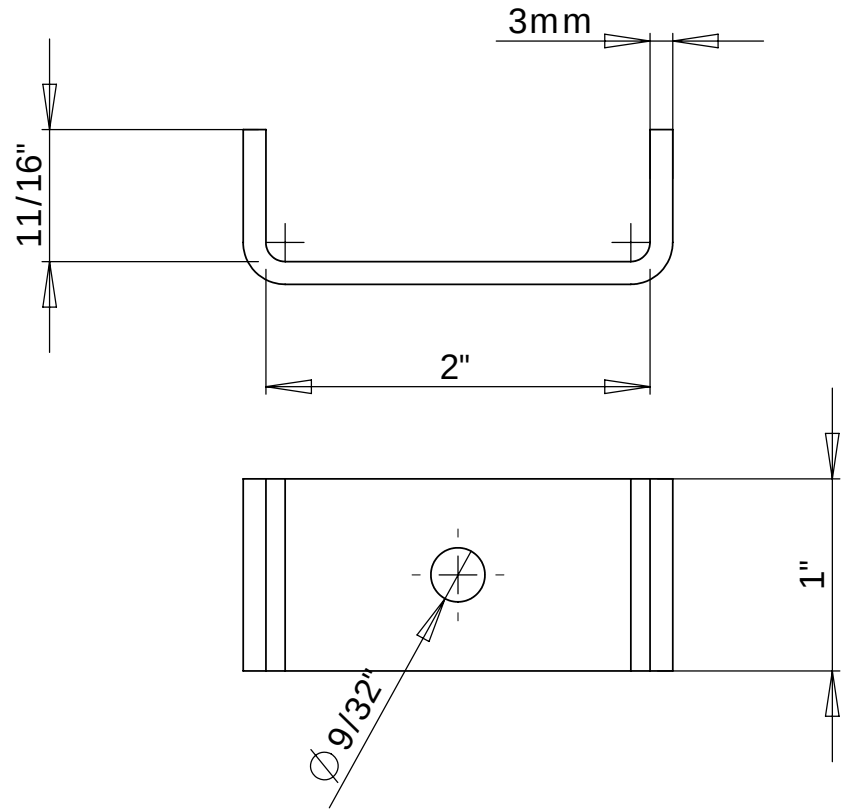
A4

WEIGHT:

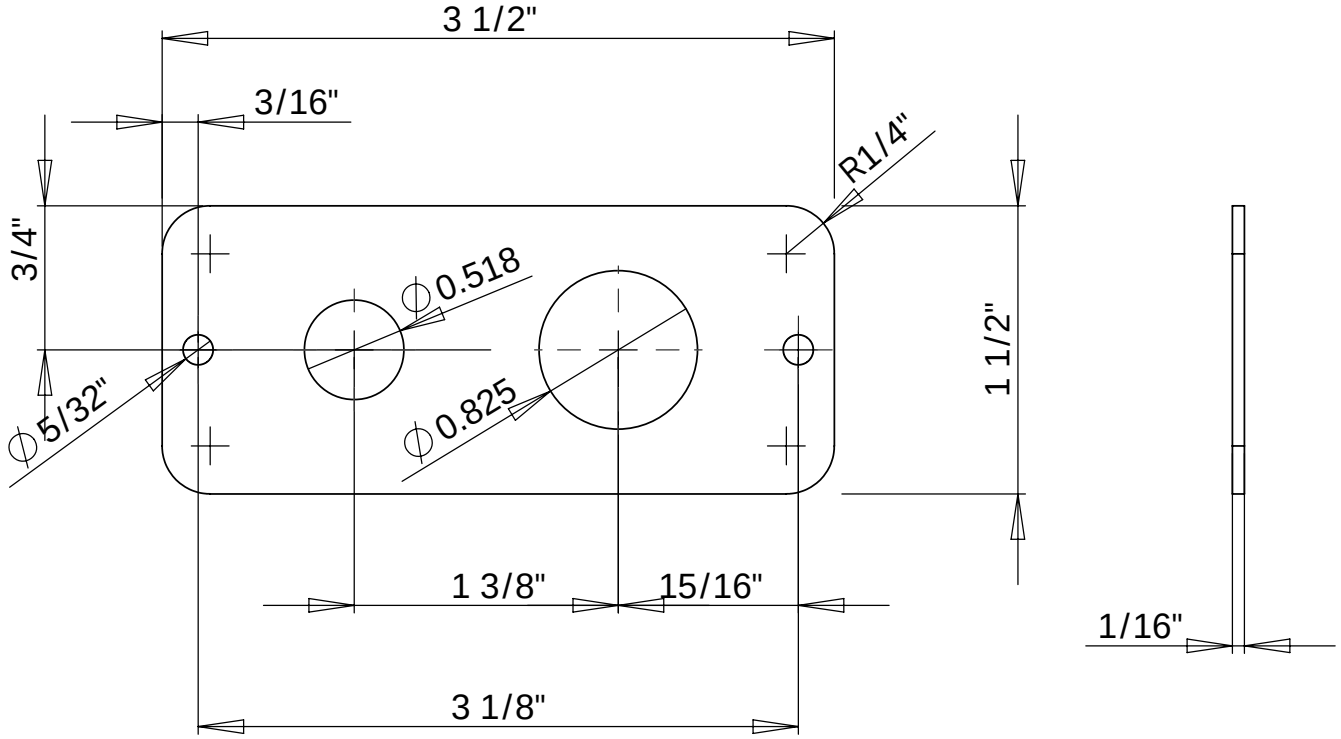
SCALE:1:2

SHEET 1 OF 1

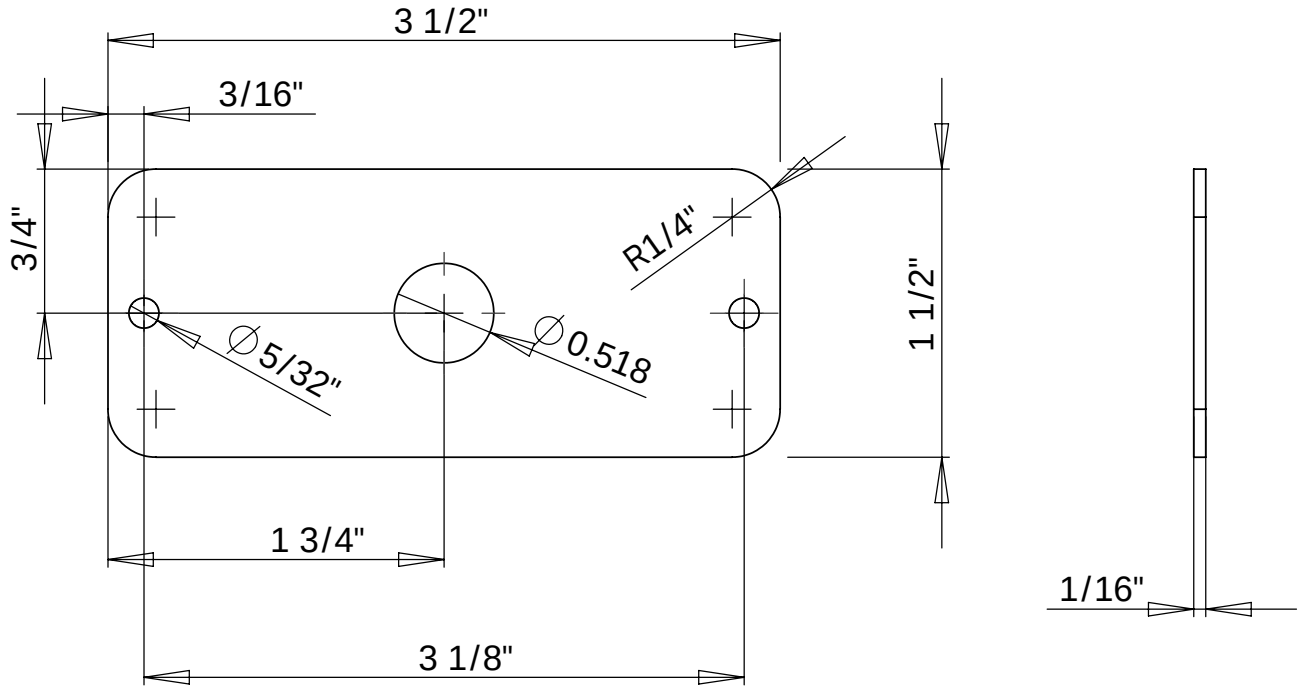

Y
Z
X



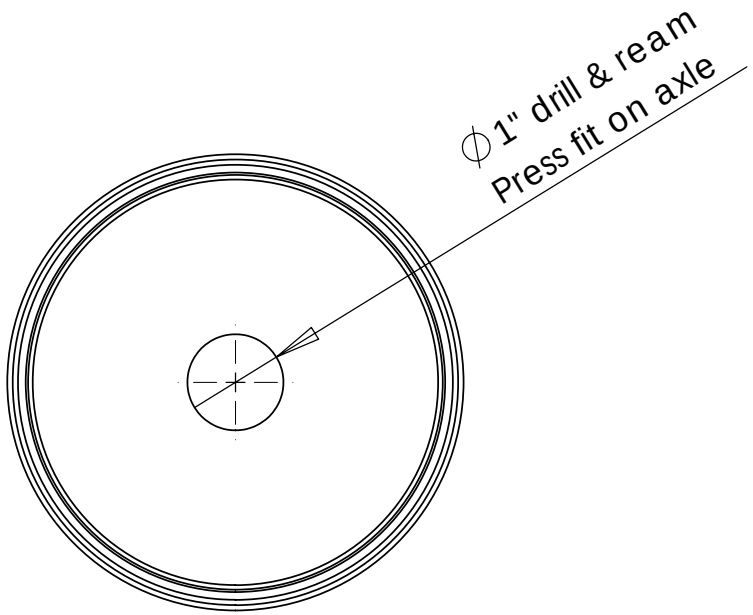
		FINISH: Natural		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
					4 - off per car	
	NAME	SIGNATURE	DATE		TITLE:	
DRAWN	J Styles		12/5/07			
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: Mild Steel	DWG NO. support brk	A4
				WEIGHT:	SCALE:2:1	SHEET 1 OF 1

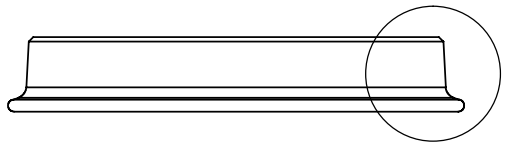


		FINISH:		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION	
					1 -off per car		
	NAME	SIGNATURE	DATE				TITLE:
DRAWN	J Styles		12/5/07				
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL: Aluminium	DWG NO. vacuum plate		A4
				WEIGHT:	SCALE:1:1	SHEET 1 OF 1	



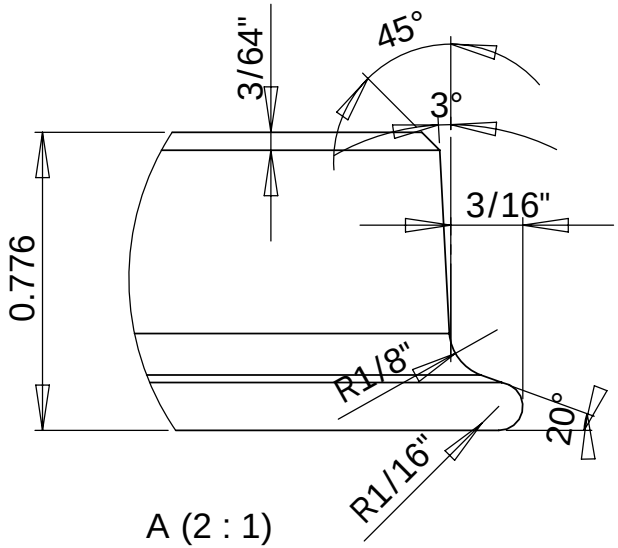
			FINISH:			DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING / REVISION
							1 -off per car
	NAME	SIGNATURE	DATE				TITLE:
DRAWN	J Styles		12/5/07				
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL: Aluminium			DWG NO. vacuum plate rear A4
				WEIGHT:			SCALE:1:1 / SHEET 1 OF 1





A

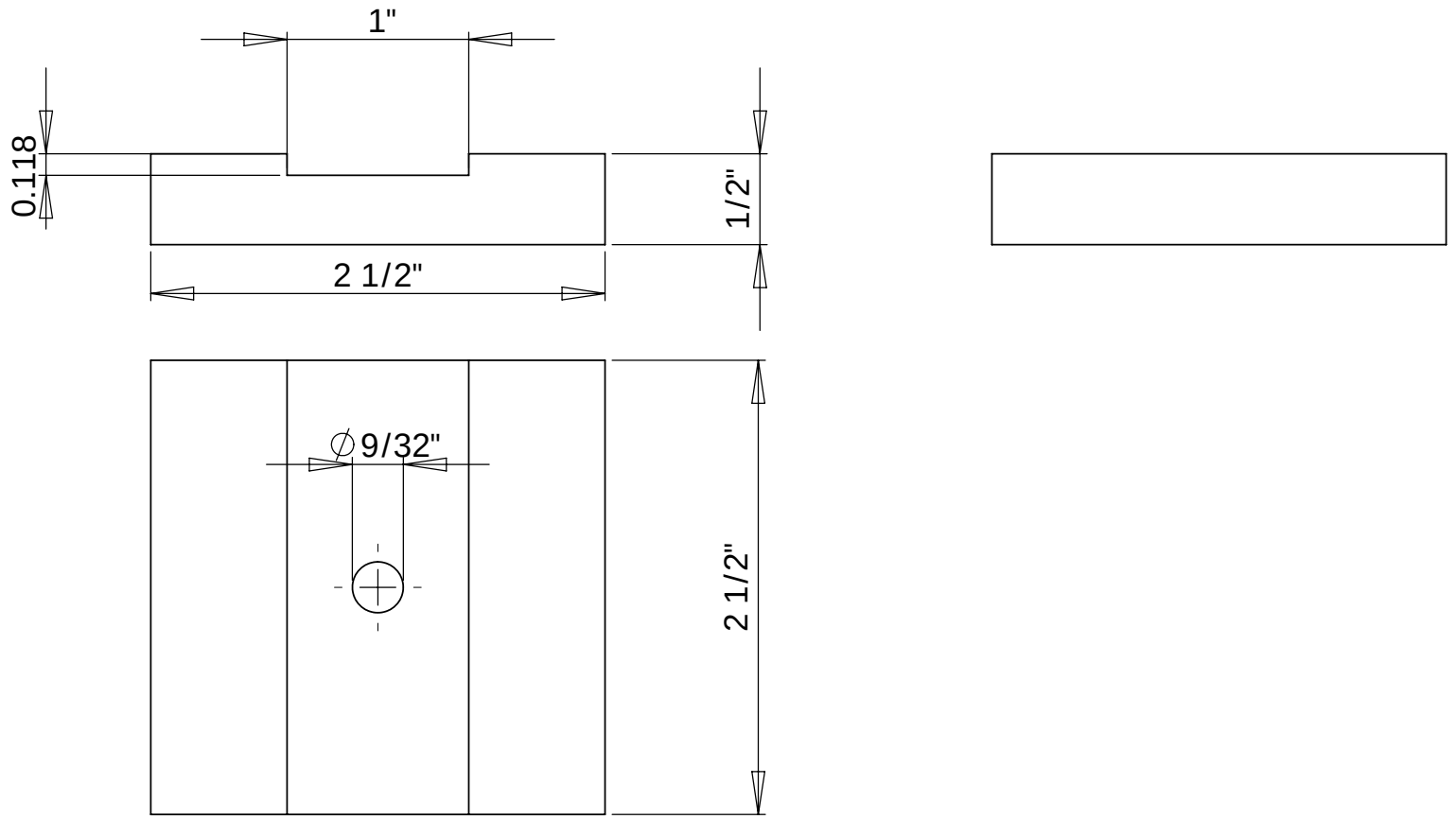
4 3/4 diameter over flanges



A (2 : 1)

REF. Flange depth is 3/16"

		FINISH: Paint black on assembly		DEBUR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING	REVISION
						8 - per car	
	NAME	SIGNATURE	DATE				TITLE:
DRAWN	J Styles		12/5/07				
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL: Mild Steel		DWG NO. wheel	A4
				WEIGHT:		SCALE:1:2	SHEET 1 OF 1



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:			DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING / REVISION
						4 -off per car
	NAME	SIGNATURE	DATE			TITLE:
DRAWN						
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: wood or plastic		DWG NO. wood block / A4
				WEIGHT:		SCALE:1:1 / SHEET 1 OF 1

CARDIFF MODEL ENGINEERING SOCIETY

Ground Level Riding Cars.

Maintenance procedure.

The following procedure is to be carried out at least twice per running season.

- The first time should be before the running season starts and in any case as close to the first public open day as practicable.

- The second time should be in the middle of the summer running season.

1. Invert the car using the plywood supports provided
2. Inspect the whole car and bogies for loose parts
3. Lubricate all brake linkages and bogie pivot and bearing pads with the loco lubricating oil in the oil store (ensure oil does not contact the brake shoe faces or wheel treads).
4. Check wheels visually for excessive wear or flats.
5. Ensure the draw gear bolts and pins are intact and not worn
6. Check brake shoes for wear, replace according to specification elsewhere in this manual.
7. Ensure the draw bar at the back of the car is retained.
8. Apply vacuum of between 10 & 12 inches Hg
9. Isolate the vacuum source and check for leaks. (the system should loose no more than 2 inches of mercury in 30seconds
10. Fit the torque lever rig to the front axle and restrain the bogie sides parallel with the car sides,
11. Adjust the brakes using the prescribed test rig to 3 KgF with the spring balance in the longest hole of the torque lever rig.
12. Re invert the car remove the plywood supports
13. ensure the front draw pin is fitted into the draw bracket at front of car
14. If a hand braked car, check operation of the hand brake.
15. Release the vacuum from the car to allow the car to be moved.
16. Check running direction is correct.

The following procedure is to be carried out before any public running day (may be done earlier as long as the trains are not divided before the public day),

1. Assemble trains in sets A, B, C, etc or to the configuration needed as instructed by the track marshal in agreement with the locomotive owners/drivers. *If possible do not separate the A B and C sets and in any case separate the C set first.*
2. ensure all vacuum connections between cars are secure
3. ensure all draw bars are secure between cars
4. Ensure a guard's seat and brake set is fitted at the back of the train.
5. Apply vacuum of between 10 & 12 inches Hg to the train.
6. Isolate the vacuum source and check for leaks. (the system should loose no more than 2 inches Hg in 30seconds
7. Operate the guard's brake valve.
8. Check every car has the brakes applied by trying to move each car a small amount.
9. Release the vacuum in the train by operating the vacuum release valve on each car.
10. Ensure a draw pin and nut is fitted to the front of the first car so that the loco can be attached.
11. Fit a short plastic vacuum pipe to the vacuum connection at the front of the first car in the set.

Note:
The torque adjustment to the brake setting at 11 above is derived from the following:

with the car brakes fully applied with between 10 & 12inches Hg, attach a locomotive using a spring balance as the draw bar, adjust the brakes on each car so that the force required to draw the car with the wheels rotating is 16kgF. It may be necessary to load the car to prevent wheel locking.

CARDIFF MODEL ENGINEERING SOCIETY

Ground Level Riding Cars.

Data Sheets

Taken from PNP instruction sheet.

PNR-1H – vacuum Limiting Valve

Connection

The vacuum-limiting valve is designed to allow a set limit to the degree of vacuum applied to the sytem through the limit valve. A filter should be fitted.

If fitting a filter; screw onto the open end of the valve.

Slacken the brass lock nut at the other end of the valve. And unscrew brass screw to the limit, put the vacuum pipe onto a hose tail and attempt to generate vacuum.

Observe vacuum gauge, which should be reading a small number. Start to tighten brass screw mentioned above until desired vacuum level is reached. Finally lock up brass nut to keep the brass screw in position.

Mounting.

Mount the valve with a small saddle or something similar, leaving access to the brass adjusting screw.

Check the valve and settings at regular intervals.

This product must not be used for any other purpose than the one described.
Its function and condition should be checked regularly. Issue 1- dec -2000

CMES NOTE

The above is the data and instruction sheet issued with the part bought from PNP. CMES checking and maintenance instructions have taken the information contained here into consideration and therefore this page is for information only and does not form part of, nor should be used as the maintenance and setting procedures.

CARDIFF MODEL ENGINEERING SOCIETY

Ground Level Riding Cars.

Data Sheets

Taken from PNP instruction sheet.

PNR-1G – vacuum Release Valve

This vacuum release valve will allow atmospheric air pressure to destroy the vacuum on specific rolling stock or indeed the whole train to allow stock movements when uncoupled or when a train has to be moved and no vacuum is available.

Connection

It is suggested that the valve is connected to the spare tail on the vacuum reservoir; this can be achieved with flexible tube and fittings from the PNP range.

Mounting.

It is suggested that the valve is mounted under the rolling stock clear of the reach of passengers, unauthorised users or dirt. A ¼" B.S.P. hole or a clearance hole can be put into a thin bracket. The bracket can be trapped between the valve and the connection fittings.

Operation

The ring is pulled to release vacuum, a cord or chain can be attached to allow operation remote from the valve. The cord or chain should be well clear of potential catchments or misuse.

This product must not be used for any other purpose than the one described.
Its function and condition should be checked regularly.

CMES NOTE

The above is the data and instruction sheet issued with the part bought from PNP. CMES checking and maintenance instructions have taken the information contained here into consideration and therefore this page is for information only and does not form part of, nor should be used as the maintenance and setting procedures.

CARDIFF MODEL ENGINEERING SOCIETY

Ground Level Riding Cars.

Spare parts list.

Supplied by PNP

Brake cylinder PNPR-1A

Insert/4035 spring 2056302s26	1 per cylinder
Insert/4036 Silicone ‘o’ ring – 4mm x 1	1 per cylinder
Insert/4037 Silicone ‘o’ ring – BS009 70	1 per cylinder
Insert.4042 BZ Plated washer 3mm	8 per cylinder
Insert/4043 BZ Plated full nut 3mm	8 per cylinder
Insert/4124 Slotted pan head screw	8 per cylinder
PNR013 Non return Valve	1 per cylinder

Vacuum Reservoir PNPR-1C

Vacuum release valve PNP part no. PNR-1G 1776k-0-05

Vacuum Limiting valve & filter PNP part no. PNR-1H

PVC tube PNP part no. PNR-1I Clear PVC tube

Bake Shoes PNP 1/8 th scale

Wheel bearings SKF6204 2Z double STEEL seals

CARDIFF MODEL ENGINEERING SOCIETY

Ground Level Riding Cars.

APPENDICES

Brake Trials and derived settings / Calculations.

BRAKE TESTS 30th June 2002

Purpose of trial:
to determine a benchmark for future testing of braking effectiveness on ground level cars.

Each car No. 31 to 37 was tested for vacuum leaks. When all leaks were corrected each car's brakes were applied with 12.5 inches of mercury of vacuum and the pull required to move the car was measured..

It was noted that the best car required more than 25 Kg force & in fact could not be moved by one man (3 man Load).

When te car was moving the reading was taken. If the wheels were locked then weight was added untril the wheels rotated, and a new steady reading taken.

The Results

		Kg force		
Car No.	**Test 1**	**test 2**	**test3**	**test 4**
31	6			
32	7			
33	13 locked	18.5 lckd	16.5	
34	9			
35	12 locked	22 locked	25+lckd	24
36	11			
37	12 locked	22		
car 33 was adjusted and retested				
33	15 locked	25+ lckd	25+lckd	car failed to move

Detail of load for above tests

		1 person	2 person	
33		18.5 lckd	16.5	
		1 person	2 person	3 person
35	12 locked	22 locked	25+lckd	24
		1 person		
37	12 locked	22		
		2 person	3 person	
car 33 was adjusted and retested				
33	15 locked	25+ lckd	25+lckd	car failed to move

Car 33 could not be moved & therefore we cannot make a true assessment of it's stopping time or distance, but I have assumed if one man can't pull it then the force required is in excess of 100llbs.

Calculations: were made for

1. The lowest reading @10mph & 5mph
2. The highest loaded braking that met the rotating wheels criteria for both 10mph & 5mph

Formulae:
Imperial units were used so that distances were expressed in units that the majority can assimulate.

10 mph = 14.67 ft/sec 5 mph = 7.335 ft/sec
G = 32.2 ft/sec/sec
W = weight of car (assumed to be 100 lbs) + weight of passengers (assumed to be 15 stone or 200lbs)
Therefore eqals worse case
Deceleration = A
Time to stop = t
F= force to decelerate car = force to keep car steadily rolling under same conditions

1. $F = \frac{W \times A}{g}$ therefore $A = \frac{F \times g}{W}$

2. Average Velocity = $\frac{\text{Initial velocity + Final velocity}}{2}$

3. time to stop (t) = $\frac{\text{velocity}}{A}$

4. Distance to stop = Average velocity x t

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1. 10 kg force empty car W = 100lb similar to car 36.

   $A = \frac{22}{100} \times 32.2 = 7.08$ ft/sec² $\frac{14.67 \text{ ft/sec}}{7.08 \text{ ft/sec}^2}$ = **2.07 sec**.

   7.335 x 2.07 = **15.67 feet** (2.5 car lengths)

   Ditto for 5 mph

   $\frac{7.335 \text{ ft/sec}}{7.08 \text{ ft/sec}^2}$ = **1. 035 sec**.

   3.667 x 1.035 = **3.795 feet** (60% car length)

   i.e. 1/2 speed = ½ time & ¼ distance.

2. 6 kg force empty car W = 100lb Car 31

   $A = \frac{13.236}{100} \times 32.2 = 4.262$ ft/sec² $\frac{14.67 \text{ ft/sec}}{4.262 \text{ ft/sec}^2}$ = **3.44 sec**.

   7.335 x 3.44 = **25.23 feet** (4 car lengths)

   Ditto for 5 mph

   1. 72 sec. **6.3 feet** (1 car length)

3. 24 kg force 3 people + car W = 700lb Car 35

   $A = \frac{52.9}{700} \times 32.2 = 2.4334$ ft/sec² $\frac{14.67 \text{ ft/sec}}{2.4334 \text{ ft/sec}^2}$ = **6.03 sec**.

   7.335 x 6.03 = **44.22 feet** (7 car lengths)

Ditto for 5 mph

3 sec. **11 feet** (1.9 car length)

4. 16.5 kg force 2 people + car W = 500lb Car 333 1st test

$A = \frac{36.37}{500} \times 32.2 = 2.342 \text{ ft/sec}^2$ $\frac{14.67 \text{ ft/sec}}{2.342 \text{ ft/sec}^2} =$ **6.26 sec**.

7.335 x 6.26 = **45.9 feet** (7.7 car lengths)

Ditto for 5 mph

3 sec. **11.5 feet** (2 car length)

5. 100lbs force 3 peopl + car W = 700lb Car 33 2nd test (Assumed stopping force)

$A = \frac{100}{700} \times 32.2 = 4.60 \text{ ft/sec}^2$ $\frac{14.67 \text{ ft/sec}}{4.6 \text{ ft/sec}^2} =$ **3.1894 sec**.

7.335 x 3.189 = **23.39 feet** (3.9 car lengths)

Ditto for 5 mph

1.599 sec. **5.9 feet** (1 car length)

Conclusions (by JS)

Car 35 12 kg braking causes wheels to lock on empty car. 11kg (car36) does not.

Max breaking force on empty car should not be greater than this or skill by driver stopping empty train with routine of checking for flats.

Car 33 2 tests worst & best result for loaded car. This illustrates reduction in running speed is easiest way of reducing stopping distance.
½ speed reduces stopping distance to ¼

To have loaded cars stopped in reasonable distance the brakes need to be set better than for light car braking (better than car 35).

OR reduce running speed to 7 mph? This would give about a 4 sec. stopping time.

In this case bench mark would be 12 kg light 15kg loaded typical buy 2 adults.

The following basic calculation for sizing cylinder and levers for adequate braking power is borne out by the more accurate and longer calculation; Diameter in the first calc is the cylinder diameter.

DIAMETER	3.1875		area =	7.980803
vacuum=	10"	4.9	lbs/in	
therefore force available to operate brakes is			39.10593	lbs f

my brakes required approx 4kg to lock wheels

The following shows the point at which the wheels will lock and therefore slide. (A bad condition) and the derated settings to ensure efficient stopping while ensuring passenger safety in not throwing them forward in an emergency application.

Maximum brake force

Diameter	3	"			
	0.0762				
0.00456	m^2				
Pressure					
20265	Pa				
Force	92.41584	N			
Strut load	336.8381	N			
Brake	673.6761	N			
coeff	0.3				
Slips at	202.1028	N at rim	404.2057	N	Car

Actual setting for Brakes

Car Brake Force	17	kgf		
	166.77	N	percent of max	41.3%
per axle	83.385	N		
daimeter	0.1	m		
radius	0.05	m		
torque	4.16925	Nm		
lever arm	0.15			
Force	27.795	N		
	2.833333	kgf		